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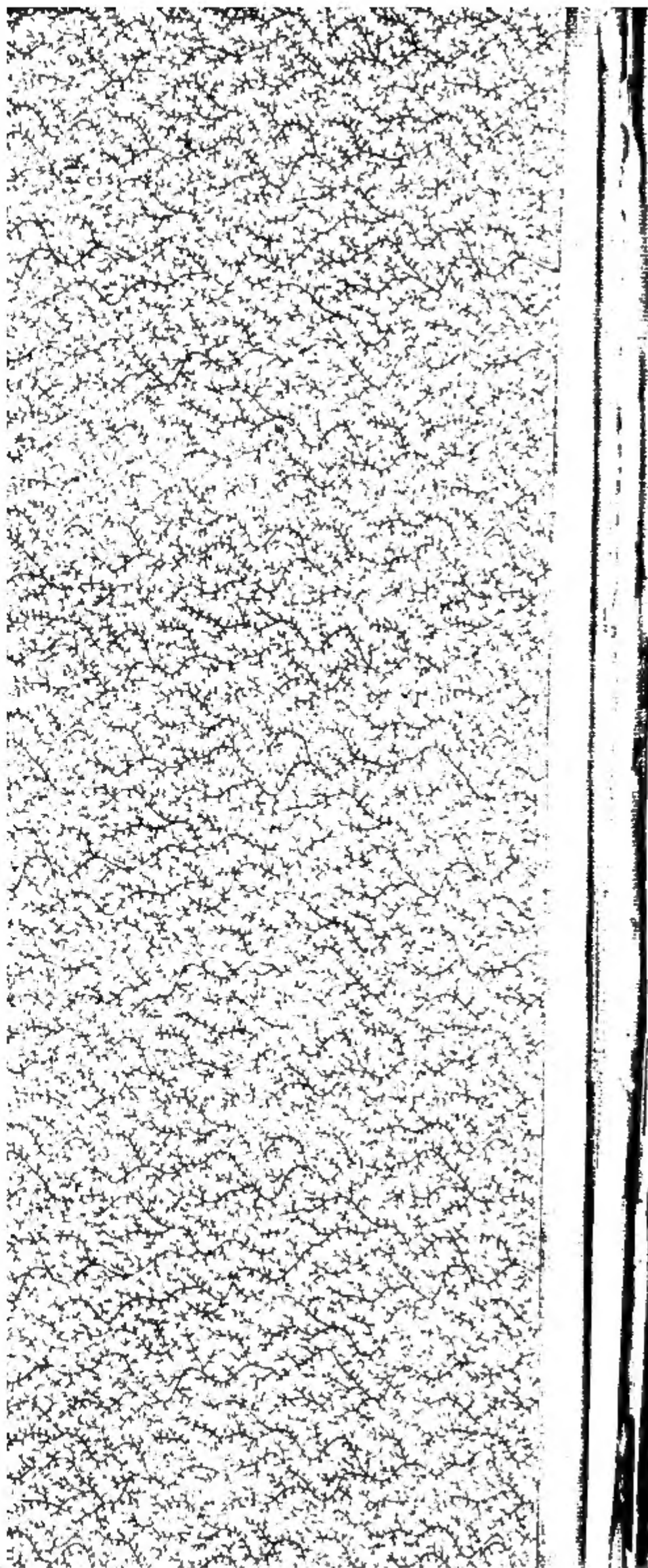
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CASSELL'S
BOOK OF SPORTS AND PASTIMES

CASSELL'S
Complete Book of
SPORTS
AND
PASTIMES

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Mr. John L. Cadwalader.

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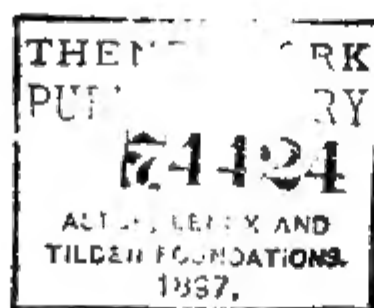
BEING A COMPENDIUM OF OUT-DOOR AND
IN-DOOR AMUSEMENTS

NEW YORK
—
WITH MORE THAN 900 ILLUSTRATIONS
—

CASSELL AND COMPANY, LIMITED
LONDON. PARIS & MELBOURNE

1896

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ROY W. B.
J. B. B.
Y. B. B.

P R E F A C E .

THE benefits of athletic and other manly exercises, from an educational as well as a recreative point of view, are now very generally recognised. There is no better means of promoting a healthy action of the body or of bidding defiance to the doctor than a moderate indulgence in sports and pastimes. But not only are these exercises of supreme importance in maintaining a vigorous state of health in our boys, they have also a peculiar and decided value in what may be called a moral sense. Listen to the wise words of the Hon. Edward Lyttelton, than whom there is no one more highly qualified by example and precept to offer "skilled opinion" on the subject. "A boy," says Mr. Lyttelton, "is disciplined by athletics in two ways: by being forced to put the welfare of the common cause before selfish interests, to obey implicitly the word of command, and act in concert with the heterogeneous elements of the company he belongs to; and, secondly, should it so turn out, he is disciplined by being raised to a post of command, where he feels the gravity of responsible office and the difficulty of making prompt decisions and securing a willing obedience. Good moral results of this sort may be expected from games wherever they have spontaneously developed." Similar testimony to the advantages of a judicious enjoyment of athletics was borne by the late Lord Shaftesbury when he opened the Exeter Hall Gymnasium.

Considering the unanimity that now exists among parents and guardians as to the desirability of encouraging a reasonable pursuit of games and sports, it is singular to observe the comparative scarcity of books which boys might consult for information upon the different topics connected with the vast variety of pastimes in which they commonly indulge. It is to meet the want of a comprehensive guide to sports and pastimes suited to the capacity and requirements of boys that this work has been prepared. Before all things and above all things it is a book for boys. No pains, therefore, have been spared to make it plain, accurate, and practical. What may be described as the "literature" of the subject and

padding of all kinds have been carefully avoided, not because such matter is not interesting—on the contrary, it is, as a rule, full of interest—but because it is not relevant to a business-like book, and occupies space that might more properly be devoted to actual details of the different games. It is hoped that in respect of the accuracy of its information and the intelligent manner in which it is imparted, and the practical character of the work, CASSELL'S BOOK OF SPORTS AND PASTIMES will hold the very highest place in the esteem of the boys of all countries, for whom it has been specially prepared.

The words "Sport" and "Pastime" have been employed in their largest sense. Consequently, not only have such manly games and exercises as Cricket, Football, Racquets, Tennis, Riding, Driving, Bicycling, Skating, Swimming, Base Ball, Lacrosse, Fencing, Gymnastics, and Rowing; such minor games, as Kites and Marbles, Playground Games, and the like; such Lawn Games as Archery, Croquet, and Lawn Tennis been fully dealt with, but Games of Skill, like Chess, Draughts, Billiards, and Bagatelle have been treated with due regard to the needs of boys. And in winter season, when most of the Outdoor Games have to be suspended for a few months, Indoor Amusements, of course, take their place. Here, then, will be found instructions for playing Round or Parlour Games of vast variety, Mechanical and Arithmetical Puzzles of wonderful ingenuity, Card Games of divers sorts, Parlour Magic, and that never-failing source of merriment and perplexity comprehensively known as Fireside Fun. In the section on "Parlour Magic" no trick has been described involving the use of apparatus in any degree elaborate. The one or two tricks of a formidable character which are there fully explained have been selected to show young conjurers what can really be done with the help of long training and expensive appliances.

Nor have we been unmindful of those lads who are either physically unable to follow the more vigorous games, or have no inclination to take part in them. For them (and indeed for the others, too) Mr. William Ackroyd has supplied a series of most interesting chapters on "Recreative Science;" Mr. David Bremner, in his pages on "The Workshop," has clearly indicated how wet weather may be turned to pleasant and profitable account; and Mr. Lewis Wright—whose name is now familiar in many households—has catered for boys of all ages and of all sizes in his chapters on "Home Pets."

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CASSELL'S BOOK OF SPORTS AND PASTIMES.

MANLY GAMES AND EXERCISES.

CRICKET.

It would be idle here to hazard any conjectures as to the origin of cricket, since so much of its earliest history is buried in obscurity. A few remarks, however, on the progress of the game will not be without interest.

Premising that there is some reason to believe that cricket is an offshoot of tip-cat, but that as cricket it can be certainly traced back as far as 1743, it was at first confined to what is now known as "double wicket," for obviously the game of "single wicket" was merely an offshoot of the original pastime, introduced to suit the convenience of a lesser number of players, though governed by laws of a similar character. According to the definition of a well-known old writer, cricket was "performed by a person who, with a clumsy wooden bat, defends a wicket raised of two slender sticks with one across, which is attacked by another person, who endeavours to beat it down with a hard leather ball from a certain stand. The farther the distance to which the ball is driven, the oftener is the defender able to run between the wickets and the stand. This is called gaining so many notches, and he who gets the most is the victor." The difference even now is not so great as one would imagine. Only alter the number and arrangement of the sticks ("stumps"), and designate "notches," in the present vocabulary of terms, as "runs," and you will have a positive definition of the ruling purpose of cricket as it now exists. At present the game universally adopted is that of "double wicket," and it is only, indeed, on the very rarest occasions that "single wicket" is ever practised or witnessed.

The game of double wicket is so called by way of contradistinction, for it requires a double array of materials—two bats, two "wickets," two popping creases, two bowling creases, and in fact is in every way, as far as accessories are concerned, a duplicate of single wicket, which needs only one wicket, one bat, one popping crease, and one bowling crease (Fig. 1); although evidently there must in each be the same necessity for two contending parties, even if the numbers engaged may be different. Originally the wicket did not consist of three upright stumps, but was more after the fashion of a skeleton hurdle, formed of two small sticks, instead of three stumps as now; and in the place of the two bails that now surmount the top and connect the three stumps, there was then merely a thin piece of stick placed across, without groove or other support. Nor was the bat the shapely instrument that it is now, but rather a rough piece of wood, devised as best it could be for offensive purposes; the ball, too, was a very inferior sample of the article as it is now manufactured, and the scoring was done by the primitive method of cutting the notches on a piece of wood. There was, too, another arrangement that wanted alteration; for midway between the sticks at the base there was a hole cut, in which the

batsman was to ground his bat after running, before the fieldsman at the wicket could ground the ball.

The wickets are now formed of three upright stumps, made usually of ash of the best growth. Across these are two "bails," or pieces of wood neatly

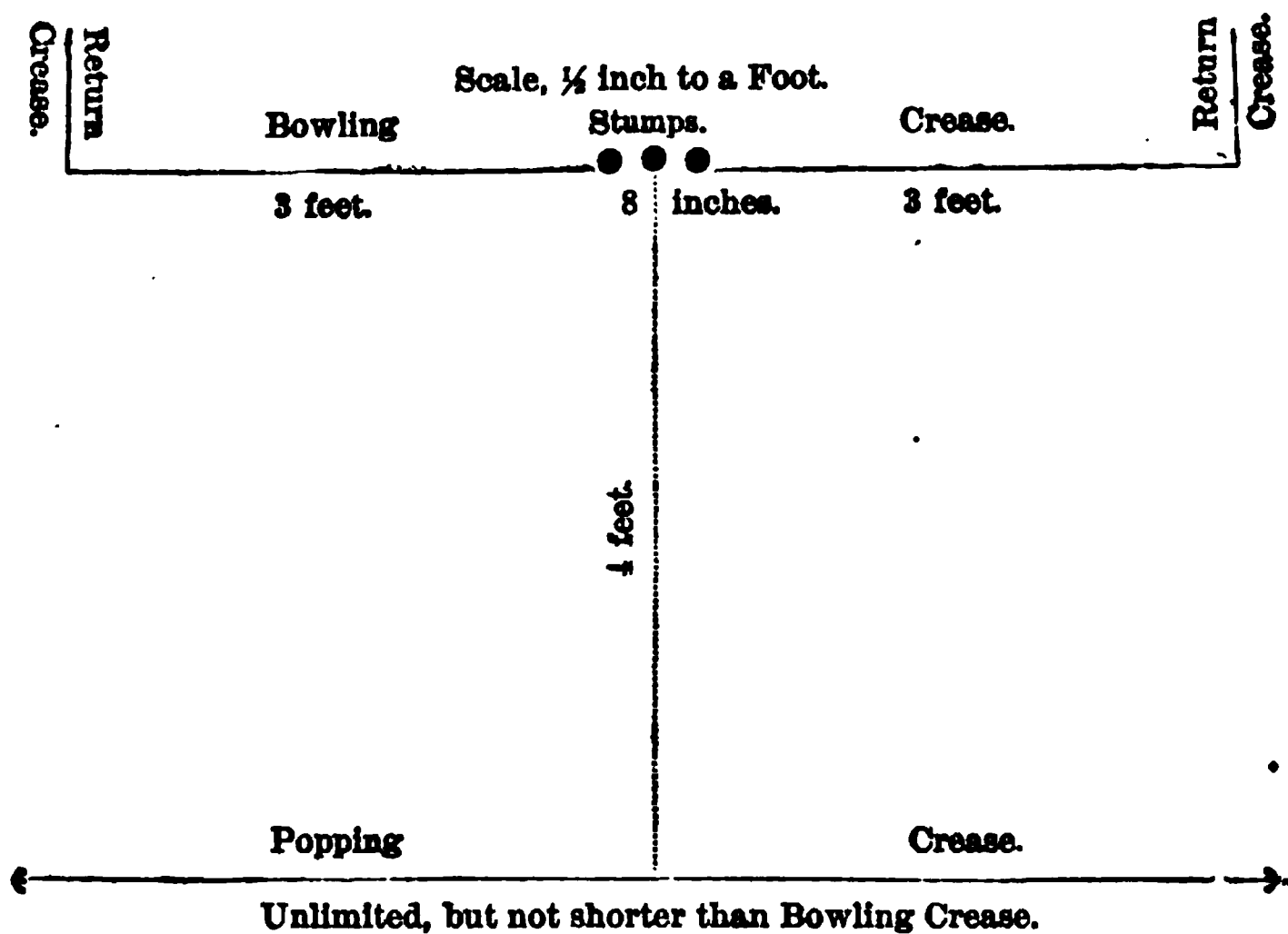


Fig. 1.—THE WICKET.

carved and turned, and made of almost similar material, each one of which connects two of the three stumps, the grooves on the top of each of the stumps serving to secure the ends of each bail. These are what is termed collectively a "wicket," and at each end of the ground, at a distance of twenty-two yards, three stumps are placed, the two erections serving to illustrate the distinction of "double wicket." In preparing for a match, the ground at each wicket must be laid out according to the annexed Diagram (Fig. 1). The "bowling crease" is meant to be a sort of check upon the bowler to prevent him from running past the stumps. Should he in delivering a ball place both feet on the outside of the bowling crease (that is, in front of the stumps), the ball so delivered is called a "no-ball." The "return crease" is intended to indicate the limit sidewise of the bowler's range. As for the "popping crease," it may be described as a kind of check upon the batsman, for should he not have one foot always within or on the crease the wicket-keeper may put down the wicket with the ball, and so "stamp" the batsman. Accordingly, the striker should be very careful never to go out of his ground. Before facing the bowler, the batsman commonly "takes block" from the umpire. "Block" is a spot usually a bat's length from the middle stump, with which it is supposed to be exactly in a line, for the purpose of covering the wicket from the bowler's attack. Many batsmen prefer a block or guard from middle and off or middle and leg to a block from middle.

The old bat was curved in the form of a butter-knife, and was obviously of little use except for the purpose of hitting—blocking or scientific play being things at that time not dreamt of in the philosophy of a cricketer. The bowling

was what is known as underhand, and the mysteries of roundhand, of curves, spins, and the other secrets of attack now so skilfully employed, were utterly unknown, so that the great point of the game was to hit without thought of defence. And hit they did with a vengeance, if we can believe some of the traditions of our forefathers.

But what about the bats and balls of the present day? What about their method of usage and their different qualities? You need not trouble yourself about the ball, in the first place, for, by a wise arrangement of things, the selection and provision of balls, in the case of matches, falls on the management and exchequer of the chief club, and directly proceeds, like many other calls, from the public purse. But with the bat the case is different, for there are imperfections that should be avoided and as critically studied as the points of a horse. See that your own special taste is satisfied first, or you will do little or no good. You can rely on the judgment of honest bat-makers, of course, but it will be much better to be informed yourself of the principal things that should be noticed in the constitution of the article that is required. See that the wood is well seasoned and of good growth, for on this you will have to depend greatly if you want a bat that will do you any honest service. See that the wood is straight grained, if possible, and give it time before you determine to subject it to hard and persistent usage. A bat improves with keeping; do not use it if you can avoid so doing, until it has had a chance of getting mellow, and becomes well saturated with the oil that you have employed. The bats used now all have the advantage of cane handles, which of course greatly increase the force of repercussion, but many prefer to have an ordinary bat at first, and if suitable, afterwards make the addition of the cane handle, which can be easily done.

There are other implements necessary to the satisfactory outfit of a cricketer or a cricket club that suggest their own different spheres of usefulness without much description. If you are a wicket-keeper you will be able to estimate the advantage of gloves specially manufactured for that post. They are positively essential in the case of fast bowlers; and it would be mere foolhardiness to attempt to undertake the task without them in these days of lightning bowling. They are made of the best mock buckskin, and perforated, so as to give ventilation to the hands without interfering with the resistance given to the ball. Batting gloves, too, are now requisites, and are dispensed with only by the more reckless followers of the game. To play cricket and enjoy it you should lessen the risks of an ugly knock as much as possible, and unless you use these articles of defence you may get your hands or fingers injured for life. Experience has made these accessories as perfect as they could well be. They also are usually made of mock buckskin leather, and the palm of the hand is cut away so as to allow a firm grasp of the handle of the bat, a strip of elastic fastening each side at the wrist by means of a button. On the back of the hand on each finger are strips of thick tubular indiarubber, arranged so as to keep every portion likely to be hit by the bowler well protected. You will see that different provision is made for the two hands. In holding the bat, the back of the left hand being exposed to the bowler, almost every part is covered, the hoop of indiarubber preventing many a nasty crack in the neighbourhood of the wrist. As the thumb of this hand is guarded by the bat, no special protection is necessary for it; the risk to the right hand, on the contrary, is mostly about the knuckles and fingers, no other part being so much exposed. Cricket-shoes are obviously accompaniments that can hardly be spared, and spiked soles are not luxuries that can be dispensed with. Laced boots, though, are more the fashion, made of buckskin leather, and these are more useful, as giving a better support to the foot and ankle; nails, too, are very popular instead of spikes. It would seem superfluous to mention the necessity of leg guards. They are

padding with strips of cane, and reach well above the knee, so that all the lower part of the leg is thoroughly covered. You can get a good knock even with these stout coverings, so do not be foolish enough to play to any sort of bowling without them. Prudence in these matters is a virtue, and not a sign of cowardice.



Fig. 2.—NET PRACTICE.

two fieldsmen will enable you to have a good practice. If you determine to have a complete outfit, get the different articles of good stuff and of good makers. An unwise economy is an expensive luxury in the end.

You will find yourself much disappointed if you labour under any sort of impression that the science of cricket can be mastered except after the expenditure of much time and patience. Do not be misled by the idea that to be a good cricketer, either as batsman, bowler, or fieldsmen, is an inborn gift. Take the converse of that hackneyed proverb about a poet, and be assured that a cricketer is made, not born. It is in batting more than in the other branches of the game that you will find practice the great secret to success. You will ask

what is the first point that will have to be mastered before you can enter on the high road to success. The answer is, *Position*. Master this one great rudiment, and you are on the way to advancement. It is not so easily mastered, though; so take the best advice, and if you can possibly secure a favourable opportunity to watch an expert and well-tried batsman at work, do not fail to take advantage of the chance. If you are lucky enough to see one of the most eminent amateur or professional players at the wicket you will find the benefit that will accrue from such a practical illustration. Do not lose sight of the first necessity of acquiring a useful as well as proper attitude of batting. As in most things, an evil habit is the most expensive to a good beginner. An easy position is as capable of achievement as an ungraceful, cramped, and crooked attitude, though the bent may be more in the wrong direction. If you can secure a tutor who will show you what ought to be

To complete the equipment of a cricket club, it will be necessary to provide a telegraph stand for announcing the scores, &c., and a set of nets for use in practice (Fig. 2). A cricket club should always have one of the latter. You cannot always get together a sufficient number of players every practice. By using nets, however, practice can nearly always be had, as it is not then so requisite to have several players. If you have a net with sides you will find yourself still further assisted, as most of the hits will thus be stopped, and no long-stop will be required, and one bowler and

Fig. 3.—PREPARING FOR ACTION.

done, and what ought to be left undone, you will not require an elaborate treatise for your edification.

Study with great perseverance the chief or stock position of a batsman (Figs. 3, 5). Try the effects of this attitude, and you will discover that you are much in the same state of preparation as is the fencer when *en garde*. You are practically, indeed, now ready for any emergency, and if you are bent on defence, and insist on a close imitation of the batsman whose attitude you have studied, it will be your own fault if your armour be not shot proof.

This position has been styled "preparing for action" (Fig. 3), and the denomination is by no means unsuitable. It is obvious enough, you will see for yourselves, that before you have sufficiently advanced to enable you to turn your thoughts to offensive movements, it is necessary that you shall have at least progressed so far as to master the ordinary plans of defence. It is essential that you shall at least be capable of maintaining your wickets erect before you venture on anything like an attack, and this you will find to be sure of attainment if you adhere without deviation to the imitation of the model here given.

The greatest preventive to your progress as a batsman will be that fatal propensity for playing with a crooked bat (Fig. 4), which has marred many a promising beginner. You had better commit any other mistake than show a tendency to use your bat in a fashion at all diverging from the perpendicular. Avoid falling into this most fatal of all errors. A player never won fame, or at least enduring fame, who did not play with a straight and upright bat. Exceptions there are, of course, and batters there have been who have for a time defied all laws made and provided, but none ever earned an undying reputation except he proved true to the great rule of batting.

Fig. 4.—PLAYING WITH A CROOKED BAT.

Experienced "coaches" will tell you to keep the right leg firm as a rock, the left shoulder well forward; and some of them, under the influence of an honest enthusiasm, will even go so far as to see that there is an impediment so placed that it is impossible to move that same right leg away from the exact position assigned to it.

If you look at Fig. 3 closely, you will see that the bat is held tightly in both hands with the fingers of the right or lower hand clenched firmly, the thumb downwards, the left or upper hand equally rigid, but in this case so different that the back is chiefly presented to the bowler, instead of the thumb and knuckles, as is the case with the right hand.

The great secret, though, is to use the bat so as to suit varying circumstances; but as this can be bought by experience only, it will be sufficient to represent the manner of grasping the handle for general purposes.

Some few wield the bat cautiously enough to suit the most exacting critic, holding it at the very bottom of the handle, just where the insertion into the blade takes place. Others, of a more reckless temperament, are used to grasp it at the very top of the handle; but here again there should be moderation, and you will find generally that the player adopting this latter line of action usually belongs to the genus "slogger," and rarely lasts more than a couple of overs in the hands of an accomplished bowler.

Of two extremes choose the lesser, and play the free and open game rather than

hold the bat in such a position that your attitude must be cramped and anything but graceful. You should make the most of your height, and stand so as to get well over the ball instead of playing over, and every now and again falling apparently over the wicket, as is the manner of some. Consequently a course midway between the two extremes may be chosen, and in this advice the support of no less an expert than Dr. William Gilbert Grace is here added. To use his very words:—"From my own experience I have always found it to my advantage to hold the bat half way up the handle, and this happy medium I recommend for adoption, as thereby you can control it as effectively as if held nearer to the blade, and the benefits incidental to the extra length are very important. To hold it higher in the handle neutralises this advantage, as the bat is not so well or so firmly grasped, and the power of hitting at a ball with certainty is considerably lessened." You have here the opinion of one of the most skilful batsmen that the game of cricket has ever produced, so that you can hardly stand in need of other counsellors.

The gift of a straight and upright style of play can never be acquired unless you adopt the primary conditions in the position. Any attempt to hold your bat so as to *show its full face to the bowler*, unless your left shoulder and elbow are properly placed, will end in ignominious failure.

You have been told what to do with your hands and arms, and now you must learn the method of arranging your legs and feet. You must first of all see that you form for yourself a position that will enable you to stand firmly without yielding an inch, while at the same time it affords the greatest facility for rapidity of motion either forwards or backwards. You must not indulge in eccentricities,

after the fashion of the dancing bear, or your career will be brief. Above all things keep your right leg as firm as a rock, as this leg essentially forms the "pivot," to regulate the movements of the batsman, and you cannot adapt yourself readily to the varying necessities of the game if the muscles be relaxed, the knee bent, and the posture generally that of a cat militant. Be sure that you insist on this stout support for your actions, for the posture of the other leg will be of minor importance, or at the best a matter of choice. It is marvellous to see the contortions in which some batsmen

Fig. 5.—CORRECT POSITION (Side view).

indulge, and still more surprising the success that attends some of those who affect the most eccentric attitudes. There are men who stand with their legs separated to the full extreme, after the form of the letter V in an inverted state, and others who give you the idea that they pay rent for the use of the ground, and are determined to occupy the very smallest possible space, so cramped is their attitude.

Place your left foot about twelve inches in front of the right, and see that it is as nearly as possible at right angles with it (Fig 5). You will find that in this position your left eye will be just above the level of the left shoulder; and more than one batsman insists upon this as an absolute essential to the acquirement of a good position. Keep your bat well down, though not so close to the ground as to hinder your quick recovery in case of hitting; for mere defence of the wicket you will soon learn to consider tame and monotonous.

To know precisely when to play forward and when to play back at a certain style of ball is an achievement in itself; but to decide on the precise course to be

pursued, and to act with the requisite amount of resolution, is a feat that will take you some time to accomplish with anything like certainty. There are some batsmen who lunge out at every ball, and trust to their keenness of vision more than to any judgment in calculation to enable them to overthrow the best-laid schemes of a bowler—to divert balls, that might have secured the collapse of many a batsman of more genuine pretensions to fame, into the next parish by a mighty swing of a stalwart arm. You will find in every quarter some players who defy all recognised laws in the dispensation of cricket, and yet attain a success that is wanting to an honest and persevering disciple of the game.

Fig. 6.—PLAYING BACK.

Do not be misled by this species of sensational play, for you will find that it is only a species of lacquer that a little friction will very soon efface.

To get a batsman into what is called "two minds" is the main aim of a bowler; and it is this very player that renders him the most effectual help. Old Felix, one of the most thoroughly qualified writers who ever discoursed on cricket, speaks feelingly on this point:—"Every well-practised batsman knows there is a spot of ground—yes, there is a spot of ground—upon which if the ball should alight it produces an indescribable sensation; and this indescribable sensation seems to be caused by the difficulty of being able to decide at the instant whether or not you should lunge out to meet it, smother it and kill it, or take it upon the back play. For when once you throw your body forward, in vain (should your judgment be incorrect) will you recover yourself in time enough to overtake the ball."

Fig. 7.—HITTING TO LEA.

As a main principle, when you are in any doubt whether to play forward or back, choose the latter course (Fig. 6). If you hesitate, you are in most cases lost; for it usually happens that in halting between two opinions you make up your mind to play forward, and your tardiness in allowing the ball a chance of rising from the ground causes you to return it gently into the hands of the bowler, to your intense mortification and the grim satisfaction of the enemy. A propensity to any excess in this habit of playing forward is one of the most agreeable sights that you can present to a crafty bowler. It is amusing to watch G. Lohmann beguiling these innocent batsmen to inevitable ruin. See him gently dropping the ball by degrees more and more towards the desired spot, until the crash

comes. Of course, this method of allurements on the part of a bowler has to be altered to suit the differences of various batsmen, and it must not be imagined that one stereotyped mechanical style has to be acquired.

Defence, and not defiance, should be the motto of the young batsman, until he has proved himself able to take his own part against the attack from first to last with the same amount of confidence. Take care of the stumps, and the runs will take care of themselves. You must feel your way gently at the outset, until you have accustomed yourself to the style of the bowling to which you are opposed, and until you have begun to understand the plans of the attacking party. If you survive the first two or three overs, you will have done a great feat, and you will insensibly begin to feel that the ball seems to grow larger and larger as the eye becomes more used to its curves, and the nerves become, as a natural consequence, proportionately braced by the improvement of vision. Some of the best batsmen, at the end of a long innings, when some unlucky and unexpected incident has secured their downfall, bewail their fate in a comical manner: "What hard luck, when the ball was as big as a balloon!" To "get a good sight of the ball" is one of the most important aims of the batsman, and care at the commencement of an innings will soon enable you to more than counteract the schemes of the most wily bowler. You will generally find that the weakness of a batsman is in the protection of his "leg stump" (Fig. 7); and it is to this special subdivision of the wickets that most bowlers seek to direct their attack.

It will hardly be necessary to explain which of the stumps is so called, but none the less there be some so far uninitiated that a definition may not be out of place. The wicket is separately designated by the title of the "off-stump," that farthest from the batsman as he stands in position; the centre one is known as the "middle stump;" and that nearest to the batsman as the "leg-stump," from being most contiguous to his legs, from the obvious fact that he places himself on guard, just clear of the stumps, to prevent his body from being in front of the wicket. Many batsmen, as we hinted before, prefer to take their guard so as to cover the middle and leg stumps, rather than the middle stump alone; but this is, after all, a matter of taste, and the advantages or disadvantages are to be learnt only by experience.

Much depends on the curve or spin that is imparted to the bowling, and your style of play will have to be so suited as to best frustrate the craft of the enemy who aims at your destruction. The intentional bias given to the ball in its passage from bowler to batsman must cause, at any time, more disquietude than is occasioned when no deflection arises from the course of the ball, as obviously with a spinning ball the batsman has a double risk to his safety, namely, in the pitch as well as in the deviation of the ball. The caution before given you, to play steadily at first until you have become used to the peculiarities of the bowling, will help you here too, as you will soon be able to make allowance for the twist imparted to the ball, and to meet the bowler at his own game.

A left-handed bowler usually may be expected to break, or twist, from the off to a right-handed batsman, so that a rule may be taken as conclusive on this point, and you will at least have your weapons ready to your hand for this emergency. It will be like the telling of an old tale to some of you to reiterate the fact that with any of this style of curvilinear bowling, the great secret is to meet the ball and remove its sting before it has a chance of inflicting deadly injury. If you allow the ball to touch the ground, you give it an opportunity of indulging in its revolutions, as it will take a fresh direction the moment that it reaches the turf. You must "smother" it before you allow it a field for the practice of its vicious purposes, or you must play back, and rob it of much of its offensive action by the defensive policy of protecting your wicket with the full

width of your bat. To smother it, though, you must see that you do not overdo matters, for if you have the slightest hesitation or doubt, play back rather than endanger your position by an erroneous idea of forward play.

You must meet the ball before it can rise so as to touch the shoulder of the bat, or you will lessen considerably your chances of success. Estimate, if you can, an angle of 45° , and you will find the best limit to guide you in holding your bat so as to avoid the catastrophe of a catch. Even then you must keep your blade well forward, so as to prevent the possibility of the return of the ball into the hands of the bowler, and with the object of keeping it as much as possible on the ground and out of the clutches of the eleven hungry fieldsmen who seek to secure your fall. In playing forward (Fig. 8), too, you must look well after the possibility of the insidious "shooter," as that ball is termed which hugs the ground and at times settles the pretensions of the most accomplished as well as experienced batsman. What a category of errors has this same shooter had to answer for since the institution of cricket! Did you ever know a batsman who did not ascribe his collapse to this much-maligned "shooter," when the ball has hit

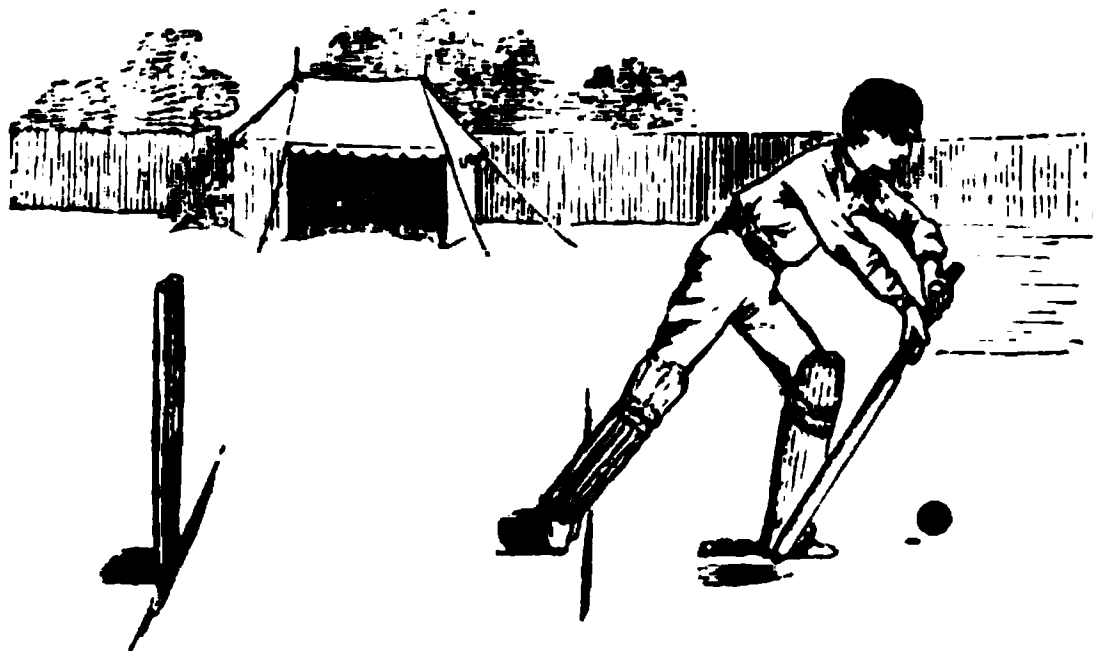


Fig. 8.—PLAYING FORWARD.

the stump far nearer to the bails than to the base of the wicket? It would be interesting to see every accident attributed to the shooter inscribed in a volume, and then calculate the number of victims who have unjustly maligned and woefully injured this self-same ill-omened species of ball. It may be that to some there is apparently no disgrace in having to succumb to a shooter; but the very fact that this excuse is made is sufficient to prove that the apologists themselves have not maintained their bat in that absolute perpendicular which is rightly said to be the main essence in the art of batting. It is possible that some would like to play cricket with shooters omitted, but this principle would be both ridiculous and impracticable, while its advocates would forget that the more the odds against a long score, the greater the glory of the achievement. Do not grumble at giving the bowler one chance more in a game where, of late years, he seems to have had a little the worse of the exchange.

In hitting a ball hard, or "driving" it, to use the recognised expression, you have by this time been tutored with patience enough to render you so far a perfect batsman, but you still have a few miles left before you can hope to reach the end of your journey. You have still to learn the art of "cutting," as the action of hitting a ball by means of the wrist is usually denominated. You have still to learn one of the most effective hits in the possession of an expert batsman, and you can never hope to attain your diploma of the college of batsmen unless you have to some extent mastered this great necessity. Much of the efficacy of this hit depends obviously on the batsman's strength of wrist, but even with this faculty no great success can be achieved unless the eye be quick and the judgment ready to time the ball well as it rises from the ground.

There are two methods of cutting, known respectively as the "forward cut"

and the "late cut," though the latter is the more efficacious as well as the more elegant, and likely to confer the greater honour on the rising batsman. The forward cut resembles more the ordinary drive to the off, with a slight infusion of wrist, and indeed at times it puzzles the most learned observers whether to characterise those hits that pass just in front of point, as cuts or drives. You cannot mistake the true cut, though, for it is different in every way, and, moreover, its own special brilliance prevents the possibility of its identification or confusion with any other stroke (Fig. 9). Watch any batsman who has acquired eminence in his profession, and it will not be long before you see the ball spinning

with a velocity that you could hardly believe it capable of, through the slips, careering past long-slip, and giving him a run, for which he is—you can see he is—extremely grateful. If you have taken the trouble to watch minutely, you will have discovered the precise method in which this graceful stroke was accomplished, and you will be able to try a little of the same species of stroke on your own account. You will find that it will take time to achieve, just as surely as many other lessons that seemed as simple; you will have to work with energy, and continue resolutely until you have overcome the difficulty. If you can learn at all from written precepts, you will do well to study the position that I give.

Fig. 9.—THE CUT.

Take notice that in this hit the relative uses of the two legs are reversed. To realise the cut proper you will have to make your left leg the pivot instead of the right, as is usual in most of the ordinary hits, and the right will have to be used, as occasion requires, to promote the correct timing of the ball. You will have necessarily to follow, as it were, the course of the ball, or rather to face it as you are in the act of hitting. Much of the secret of cutting consists in the judgment with which the ball is timed, and a few trials will convince you of the correctness of this assertion. If your eye and mind act well in concert, you need have little fear of failure, and practice will further enable you to make sure of your aim. It may be that you will never be so proficient as some who have become almost representative batsmen by reason of this one hit; for to cut brilliantly demands that you should be able to calculate the time and rise of the ball to the veriest nicety; and flexibility of wrist is required rather than the possession of anything like herculean strength. It is a stroke, none the less, that you should cultivate and endeavour to master, although there are reasons why even the cut should be administered with caution and never abused.

You will find here that a heavy bat will seriously interfere with the success of your efforts, so do not be misled by the idea that an addition of a pound or two avoirdupois will give you any advantage over the rest of your fellows. Some young players seem to think that it adds to their renown to wield a bat that more sensible plodding souls reject on utilitarian principles. In cutting you want a bat that you can raise with ease, not one that will cause the tendons of your wrist to ache for a week afterwards. You want a bat that you can command, so that you can slide your hands, if required, to the very end of the handle, for you will discover that sometimes you get a ball so wide that your fingers itch to smite, even under the direst risks, and your hands will insensibly glide along the

handle until you have got the bat stretched to its farthest limit. It is the ball just outside the off stump though, that you will find most available for cutting; and if you time it correctly you will marvel at the rapidity with which it glides away, twisting like a serpent, and leaving behind it a track such as no other style of hit has the power of producing.

There is a great consolation for you in learning this same secret of hitting, for if your physical powers be less marked than those of many of your fellows, you will not be placed on any inequality in this respect. Some of the most noted instances of famous cutting have been made by batsmen of insignificant stature, so that you need not be deterred by any want of muscularity.

Learn to time the ball first, for in this one point lies the real secret of all the brilliant hitting, either in the past or the present. Time the ball, then, so that you can calculate its course with sufficient certainty to know that it will bound well to the off; you will instinctively draw back as if you were preparing for the first attitude in fencing, and the bat will be raised up, straightened horizontally, instead of perpendicularly, as in the common order of events. You had better allow the ball to pass you rather than be anxious to anticipate its arrival. If you let fly too soon you are liable rather to retard than assist its progress, and unless the ground is such that the ball comes accurately to you, there is a great likelihood that you will find yourself placed in the ignominious position of succumbing to the dexterity of the fieldsman at point. Do not forget to hit with the blade of the bat turned slightly downwards, if you wish the ball to skim along the ground instead of soaring to the sky. If you fulfil this injunction, and wait well for the ball, timing it with any degree of accuracy, you will have the satisfaction of witnessing the ball glide on behind point, with a velocity that seems inexplicable. It will be useless for long-slip to attempt to prevent its passage, for it will be well out of his reach, though the glory of following it until it has realised four or perhaps six runs will surely fall to his lot.

Possibly the earliest ball in the experience of a cricketer is that which is professionally known as the "half volley"—the easiest, provided that your bat is not out of the perpendicular. You must understand the half volley proper to consist of a ball pitched so far up to the batsman that he can reach it easily, without inconvenience, as it rises from the ground. It is the most brilliant, the most effective, the most manly of all hits, if you have acquired the art of hitting it as it should be hit. You can put every particle of strength at your disposal into the manipulation of the half volley, and the firmer the stroke and the more accurate the timing, the greater the success that will attend your inspiration.

But a young player had better refrain from the hit altogether, and be content with playing the ball, unless he can make good terms for himself. If you have made up your mind, and are bent on striking, get your body well set, so as to give a good swing to the bat, and avoid irresolution, of all things. A determined hit will often prevent a downfall, even if the ball should be thoroughly miscalculated, when a tamer course would lead to inevitable ruin. The same remark applies equally to the half volley, whether it be on the off stump, straight to the centre, or directed towards the leg stump, though the circumstances may have to be slightly altered. The ruling principle is alike in each instance, that the ball should not be hit otherwise than at a certain height of the bat. Avoid hitting it too low on the face of the bat, for much of its rebound will be lost, unless it is allowed to get slightly above the level of the ground. Be equally cautious, on the other hand, against its contact with the bat above a certain height, as if it be straight there is a chance that it may be seized by the bowler, or if it be on the leg stump, that in hitting you may give an

opportunity for a catch either to short-leg or to long-stop. The intermediate course will be most serviceable, as you will soon discover. If you time the ball so that it meets the bat at about one foot from the bottom of the blade and just as it has risen about six inches from the ground, you will instil terror into your foes by the venom of your hits. Only do not jump to the conclusion, in a moment of self-satisfaction, that every ball is a half volley, or your fate will be sealed. You will have another such opening soon enough, if you only wait patiently and resist temptation.

Perhaps the greatest of all curses to a young batsman is the possession of any distinguished powers of hitting. The necessity of acquiring the great secret of successful batting in early life cannot be over-estimated, so continue until you have effectually secured this necessary accomplishment. If, though, you are a hitter beyond all hope of recovery, take a word of advice, too, in season. Do not leave your ground even to do this, for here you lose, without doubt, the best of the many chances in your favour. You see some good hitters run out at balls wide of the off-stump, and make one jump to give a lever to the stroke; but the twist comes, and they are irremediably stumped. You will have dangers enough in the risk of catches to eleven hungry fieldsmen, without adding stumping to the list of possible catastrophes. You should be careful, too, to play in a match the same as you do at practice, or rather to make your practice really a preparation for the important necessities of the match itself. You will find hundreds who seem determined to neglect this golden rule. It is not at all unlikely that you may derive substantial benefit from this advice, so do not treat it scoffingly, as the manner of some is. It is obvious that any injudicious policy in unsettling the tactics of a batsman should be strictly discouraged, and yet there are many who urge on their wild career headstrong and wilful when they are receiving practice from a bowler, unfitting them altogether for the urgent requirements of any important contest. It is common enough to see these same youths hitting away recklessly and foolishly, with their sole aim to knock the ball out of the ground, or to earn the distinction of hitting into some adjoining garden, defiant of possible accident or injury to unwary and innocent souls who love not cricket. Such tactics as the above should be rigidly avoided. In practice there should be the same studious adherence to rule and precept, or what good is to be derived therefrom? You are likely enough to make a mistake, from momentary forgetfulness in a match, and you will not then have the same chances of escape when there are eleven fieldsmen all thirsting for your blood. It may be amusing enough to gratify a few spectators with a taste of your prowess, with the possibility that you may also maim or frighten any chance women or children; but the records of a match are enduring, you will remember, and the glory of a good score will outlive millions of sensational strokes at the practice net.

To some few of us the very mention of a stolen run comes with a sort of pleasant fragrance of the past. If stolen fruit taste the sweetest, no more pleasurable sensation than that of stealing a run, when runs are wanted, and the whole field is on the alert, is known to the cricketer. You have to pit your judgment against that of the enemy, your activity against the agility of eleven antagonists, and all honour to you if you are on the right side. You will be surprised to find what you can do in the way of running between the wickets when your powers are put to the test. To a good judge there is nothing more distressing than the listless dawdle that seems to actuate the movements of certain batsmen when they go to the wickets, nothing more painful than to see them stand in their ground stiff as statues, motionless as sentries, instead of aiming to assist their side by the attainment of runs far from impracticable. Do not be misled because you see batsmen of any pretension saunter and stroll

between the wickets, as if the whole game were a business to be performed with as little trouble as possible, instead of an exercise to encourage the use of every limb, and the development of all the muscles. You should regard the loss of every possible run as an offence that should receive condign punishment. If you have a chance of getting in with a partner who understands you, and will act in concert with you, runs which seemed impracticable will lose all their difficulty, and you will find that the distance between the wickets reduces itself wonderfully the better the sympathy between your partner and yourself. To see Jupp and Thomas Humphrey run in the days when Surrey was at its best was a treat worth going miles to see. You seemed to enter into the spirit of the game itself when you saw how complete was the understanding that prevailed between the two old comrades. No loud shout of "Come!" or "Run!" to make the whole field on the alert, but a tacit understanding that did better than whole volumes of advice. It was just a shake of the head, or a nod, and the thing was done.

Directly the ball has left the bowler, be ready to make as much of your way as is prudent towards the ground of your partner. Do not be over-anxious, and avoid as much as possible any movement that may be likely to give the enemy an idea of your intentions; but be vigilant as well as resolute, and you cannot fail. You will see good runners invariably effect a run when the batsman has played the ball just in front of his bat, and the whole field applauds vigorously, as if the feat had been one of great difficulty, instead of one of comparative ease. You will find often that the runs which appear most hazardous are free from all risk, and this is a notable instance:—You have backed up well, and are midway between the wickets, so that it is easy for you to reach the batsman's end before the wicket-keeper can turn to assail your stumps. So far then you, at least, are safe, while your partner, provided that he act well in concert with you, has divined your intentions, and is well on his way towards the end that you have left, to the annoyance of the wicket-keeper, who either fumbles the ball, or fails to get in time, or, worst of all miseries, makes a shot at the wicket, with the likelihood of assisting your score materially by the aid of an overthrow. Remember, above all things, that in running, the man who hesitates is lost. It is of no value to you to learn afterwards that you might have saved yourself if you had only made up your mind at first, either to stay in your ground or to run at once, instead of vacillating between the two courses to your certain ruin. There is no midway passage open to you, as a rule. You must either run or give your partner a *decisive* word of command, so that he may be able to act on your order at once.

You will have to use your own discretion in many cases, for one fieldsman will place you in danger when you may be safe with all the rest of the side. You will have to make up your mind according as the ball is travelling, slowly or with speed into the hands of the fieldsmen. There is nothing more pleasing to good batsmen, or on the other hand more likely to tantalise and demoralise the whole field, than a run made when the ball is slowly trudging along on its way to mid-on. There is no surer run for you if you back up well, there is not the slightest risk in your own case, while your partner can presume on the same immunity, as the player who picks up the ball cannot possibly turn round to assail his wicket. You must be careful, though, not to use words that may be misunderstood when you call for a run. If you decide on not running, you will do well to communicate by means of the usual negative, "No!" or if bent on a run, signify as briefly as possible your intention with the word "Run!" You must be on the alert, with your gaze always fixed on the ball, or you will lose many a run that is perfectly feasible. It is ridiculous sometimes to see the chances that are allowed to escape, even by the best batsmen in the best matches. You will see players,

whose education should have been more highly finished, jog along between the wickets with their back turned to the ball, as if to effect one run alone was a feat arduous enough of itself, without having to expose themselves to the trouble of effecting a second. You can never tell what may occur if you "run the first run sharp." You may secure runs by good running that are utterly impossible from the bat when the bowling is well on the wicket: You have to keep your side, and you can materially benefit the cause by training yourself to be a good judge of runs. You will have to back up always on the assumption that the ball *may* possibly be muffed by one of the fieldsmen, even though they are the most expert representatives of the art. It is not enough that you should rely on the known skill of any special player, and count on the quick return of the ball, for a blade of grass or uneven piece of ground may entirely divert its course, and you will then have the dissatisfaction of learning that you have lost a run. You really cannot estimate the disastrous effects that may happen to a side even from one of these runs, when the game is at a critical point, and you are straining every nerve to prevent the better of the two batsmen who are in from securing the ball. You do not know how severe is the agony of a bowler at finding his analysis spoiled again and again by the achievement of these same sharp runs, with the possibility of overthrows to make matters still worse.

The best long-stops are often utterly unmanned by a good runner, a whole field thoroughly soured and demoralised, and a probable victory turned into a certain defeat solely by a batsman bent on making the best use of his time, and turning to good account every likely chance of a safe run. You will have to be cautious, though, and be careful not to overdo matters, or you will fail ignominiously instead of succeeding as you ought to succeed. You will have to use your discretion in running to certain fieldsmen; and beware how you run to a left-handed man, or your fate will be speedy! Nor is it wise or judicious to over-run your ground, as you will see many do, passing yards behind the wicket instead of planting their bat just within the crease, and turning at once in the hope of another run. You will soon be impressed, too, with the benefit of running with your bat well in front of you, and all along the ground, as by this means you will gain many a yard when it comes to the question of a close run. Lastly, do not over-run yourself, but take time to recover your breath, and do not let your eyesight suffer merely to effect a single run. Remember further that, if you hit the ball in *front* of the wicket, it is *your* business to judge the run; your *partner's* if the ball is hit *behind* the stumps.

BOWLING.

If you are under the impression that you have mastered the art of bowling because you have gained a certain amount of mechanical precision in directing the course of the ball, you are very much mistaken. You must banish for ever the notion that precision is all that is required to become a great bowler, or you will have wasted much time and labour that might have been more profitably spent. You must recognise at once the fact that to secure eminence as a bowler needs gifts that all do not possess, as well as a degree of nerve that practice and experience can alone produce. You need patience and resolution, as you well know, to become a good batsman; but you require, in addition, a keen perception, and a readiness to discover the weak points of your adversaries, or you will never mature into a bowler of the highest rank. It is not enough to peg away for an hour or more at the wicket with hardly a ball off the line, for the machine known as the catapult will satisfy you in this respect without the necessity of a more active foeman. You can pick bowlers by scores with the greatest accuracy who can pound away without flagging, and give you excellent practice,

but still totally unfitted for the exigencies of a match, by reason of the same monotonous action, and the entire absence of anything like variety in either pitch or pace.

It is not difficult to deliver one ball out of six that would prostrate one or more of the stumps against which you have to direct your attack, but you want much more than that before you have passed your primary examination in the school of bowling. It is not always the strongest ball that is the most successful, nor is it the best balls that are the most likely to secure the downfall of a well-qualified batsman. Still, you must have thoroughly grounded yourself in the rudiments of the art, and gained at least a modicum of confidence, before you can venture to think of experimentalising on your own account.

Do not be misled with the idea that it is the bad bowling that succeeds, or you will have utterly misconstrued the meaning of these remarks. What is meant is that the head of a bowler will often avail as much as, or perhaps more than, his arm, and that study will help materially to improve your position as a bowler. Remember that a bad ball is more useful than a good ball *at the proper time*. You will find it a less easy task than you suppose to secure a facility in guiding the course of the ball, so be cautious, and do not disparage the advice of those who have plodded cheerfully over the same road. You must possess patience and perseverance, too, or you had better make up your mind to give up the quest as hopeless. If you want an instance to encourage you, it is certain that the veteran Lillywhite, one of the craftiest generals, as well as one of the most complete masters of the ball that cricket has ever produced, used to practise during the winter in a barn, labouring to achieve the greatness he ultimately gained. It is not sufficient that you should take the ball up once and again at lengthy intervals, but that you should make bowling an absolute study. You must be prepared to adhere to fixed principles, moreover, or you will seriously hinder your progress. Do not follow the pernicious example that is often set to young bowlers, and tear away until you are too fatigued to lift your arm, or move a muscle. It is essential that you should feel your way steadily, or you will find yourself gradually transforming what should be a pleasure into an annoyance, as well as pain. You must husband your strength until you have become inured to the exertion, or you will learn to your cost that you have overtaxed your powers beyond hope of recall. If you are bent on becoming a really useful bowler, you will do more good by bowling for a short time, with occasional spells of rest, than by labouring on until your arm is tired, or your hand so benumbed from stiffness as hardly to feel the hold of the ball. You must guard, too, as carefully against the policy of fast bowling on the part of a young aspirant, for this is a system equally pernicious. More good would arise from the practice of underhand bowling at the first than by encouraging the adoption of the round-arm delivery, until some degree of accuracy as well as power has been obtained.

There must be some little spot between the line of the wickets more vulnerable to a batsman than any other. You will have to direct your aim at this, though obviously you will have, in an absolute contest, to alter your tactics and vary your bowling as occasion requires, to trade on the exposed weakness of any special batsman. When you have so far progressed as to be able to maintain a continuous fire on this debatable ground, you can be sure of immediate promotion. You can easily make the precise place well defined by depositing a piece of paper on the ground, so as to prevent all chance of misdirection, and you will soon value the utility of having this distinctive mark. You will, first of all, have to master the power of holding the ball completely under control, before you can aim at higher flights; and this practice of accustoming yourself not to bowl without having some definite object for your target, will help you materially.

Do not over-bowl yourself at the outset, but try your strength with a low delivery, and a pace that will not tire or fatigue you. You will find at first that you will have some difficulty in pitching the ball far enough, though the distance does not seem very great until you have tried. You had better do anything than retain that fault, for short bowling is the worst of all, and even one long hop in an over is a fatal mistake that you must seek to overcome at all hazards. You will assist your future prospects, too, more than you can imagine, by selecting a neat and easy style of delivery. It may be that you have already formed a habit in this line that you cannot well eradicate, and in this case the advice may come a little too late. It is certain that the more easy and less exhaustive the style of action, the better the chance of a bowler retaining his skill for any length of time. If you have, unfortunately, contracted the habit of bowling spasmodically, without the measured steady swing that should mark the movements of a first-class bowler, you can hardly hope to last, although you may electrify the world perchance for a few brief seasons.

You have been fortunate, then, let us admit, in choosing a style of action that will be of permanent use to you, and you feel that you can bowl without contracting your muscles or cramping the play of your limbs. So far you have done well enough, but you will have to be careful, too, that you do not vary the action, even in practice, and that you adhere unflinchingly to the method that you have decided to adopt. It is essential that you should endeavour to make, at least, this part of your study mechanical, and that you should never allow yourself to be tempted into conflicting habits that will certainly mar for ever your chances of distinction as a bowler. Do not be lured into the error of bowling even one ball on any other terms, for you can hardly guess the importance that may attach to the slightest relapse from the usual routine. Commence slowly, at a pace that will serve to give you confidence, instead of aiming at once at the accomplishment of a lightning speed that will inevitably bring you to grief.

Do not indulge in any fanciful contortion in the way of delivery, but keep your body as upright as possible, and endeavour as much as you can to present your full face to the batsman when you are about to set the ball on its way. You will have to keep the opposite wicket entirely in your line of sight, or you will fail, as does the billiard player who diverts his gaze from the object ball. Forget, to a certain extent, that you have the ball in your hand, and think only of the stumps that you have to attack, and you are sure to fall into a settled gait as well as an action that will in all likelihood become habitual.

You must train, as in batting, your hand and eye to act in concert if you are keen and enthusiastic in your pursuit of bowling.

It will do you infinite good to note the pace and style of celebrated performers with the ball, and you will see for yourself the almost mechanical perfection that practice and strict adherence to fixed principles can produce. You may derive a useful lesson from noticing the absolute ease of their movements in contrast with the laborious and stilted style of others, and you will recognise the value of the advice of maintaining one undeviating action at all times and under all circumstances.

You have by this time made your selection, and have profited so far by the instructions as to have fallen into a style of action that has become habitual by reason of persistent practice. So far you have done well, and mastered at least the most difficult of the early rudiments of the art. You have grounded yourself already in the more mechanical branches of the pursuit, so that now you will be able to devote your attention to the scientific application of your powers, and reach even to experiments. You will have to learn how best to hold the ball, for so much depends on its course after leaving your hand that every possible advantage in the manner of holding has carefully to be studied. It is obvious

that most of the rotatory tendency which proves so effectual in the case of some bowlers, is owing to the method in which the ball is held when it leaves the hand, so that no chance should be allowed to escape in this direction. There are some who deem it to their advantage to hold the ball in the palm of the hand, but the plan is injudicious, and will in no way assist the object in view.

If you come into close quarters with a bowler cunning in device, you will find that he has quite a tight grasp of the ball, allowing the tips of the fingers to touch the seam, in order to impart the greatest amount of "spin," on the assumption that the fingers have the chief power in ruling the delivery. You will, if you watch, see him sometimes, too, carefully (Fig. 10) pressing along each side of the seam with the nails of his fingers, with a view to raising the seams, and so imparting to the ball a certain extraneous influence, that may assist its course when the part so manipulated comes into contact with the ground. You will require something more than a mere facility for accuracy of bowling when you have to meet first-class players, so that you had better make all the necessary preparations as you advance, instead of having to retrace your steps to recover your losses. "What sort of a bowler is So-and-so?" you may hear often enough, and the inevitable reply, "Oh! straight enough; but there's nothing in it." What you want is the talent for imparting to the ball a spin that will cause it to twist, jump, and take the greatest advantage of any inequalities of ground. It may be that at times there are fields so level, turf so well cultivated, and surface so perfect, that the best bowler cannot infuse the slightest break into a ball, but it is very rarely that you will be unable to discover something that will help you in giving impact to the ball. Certain peculiarities of action no doubt tend to enable bowlers to procure the desired spin, but generally it may be said to emanate from a certain mechanical combination of arm and wrist. You cannot hope, though, to fathom the mystery of this rotatory motion from any written treatise, so you must judge for yourself as much as possible by practical experiments, profiting, if within your reach, by the tuition of a well-qualified master. You can do much to help this spin if you study the matter thoroughly, for it is marvellous sometimes to witness the eccentric vagaries incidental to the course of the ball when it reaches the ground, propelled from the hand of a bowler who has reached perfection in this matter. You will see that the aim is to encourage, as it were, the action of the spin by a certain shove or jerk after delivery, as if under the impression that the tendency to rotation may be reduced if the process be not continued until the ball has finally left the hand. It is only, too, by care that you will be able to retain this twisting delivery, for overwork has the inevitable effect of deadening the feeling at the fingers' ends, and when this sensitiveness has gone, a bowler may be said to have reached the first step on his downward course.

Fig. 10.—HOLDING THE BALL FOR THE SPIN.

"It often surprises me," remarks a bowler, well known in his day, "that there are not more bowlers of merit, as I am quite sure that a large majority of cricketers, both gentlemen and players, could bowl well enough to be of use in a match if they would only try. Of course, to become a skilful bowler requires much study, and I can safely say, from experience, that it is an art that must be cultivated for many a long day. Any cricketer possessed of a hand and eye quick enough for fielding, as well as a sufficiency of intelligence to bat well, cannot fail to bowl if he will only give the art of bowling some time and patience. As far as

I know, the art of bowling lies in managing the body in such a manner as to walk or run a few paces to the crease, and then, having the body and arm well balanced, to let the ball leave the hand *at the proper moment*. The actual movement is purely mechanical, dependent on precision, and the secret of success is, first, a true love of the sport, and secondly, great patience and practice.

"The spin of the ball, and the judgment requisite to puzzle a batsman, are matters entirely of experience, and can be learned only after the bowler has acquired the art of hitting the stumps with certainty. I do not think—the exceptions only serve to prove the rule—that the very fast or tear-away bowling is calculated to finish a match on a very good ground, unless the bowler is very superior, unless he can make the ball cut across the wicket, or unless the ball shoot from wet or other causes. Fast bowling is very expensive at times, in byes, and snicks through the slips; and a lucky player, by just turning the ball, may score five runs without any skill on his part. My idea is, that the bowler should bowl well within his strength, and should have as his main aim the attempt to weary the batsman's patience by a well-sustained attack. He must expect to be punished occasionally, but it is often the first sign of hitting in the play of a batsman that serves to encourage the bowler. Obviously, the first two points to be studied are precision and a certain command over the ball. Look at some of the best bowlers of the North of England, and consider how some of them have reached distinction. Why, I believe that the supremacy of the North over the South in the matter of bowling is due solely to the persistent study the Northerners give to the cultivation of the art. In the Northern and Midland Counties, perhaps from indirect causes, bowling is greatly fostered. I have in some parts myself seen colliers and labourers of all kinds, during their leisure hours, at practice with a ball at a stone or piece of coal on the road or on the moors, no matter where, so long as they can have something whereat to bowl, at the regulation distance of twenty-two yards; and the consequence is, that they can almost all bowl with accuracy, though I am inclined to think that they very unwisely consider perfection to be represented by swiftness of pace, and do not devote sufficient time to the cultivation of skill in slow and medium-paced delivery."

You will find hundreds of batsmen who can play fast bowling well, but few who excel when pitted against men whose pace is so slow as to allow the batsman ample time to deliberate and fidget himself into a glorious state of irresolution. This may be taken as a general rule. You may be able to produce exceptional instances, such as those of Spofforth or S. M. J. Woods, where fast bowling has been to a certain extent placed in comparative subjection; but the cases on the other side of the question will be still stronger. If there were placed in opposition to you any bowler above the ordinary medium pace, you would feel at home, because you would have every now and again a ball that would enable you to give full scope to that favourite cut of yours, or a half volley that you could play forward for five or six, with the assurance that the fieldsmen were not placed deep as they are to accommodate the requirements of a slow bowler. You can play many a fast bowler, as you say yourself, "for a week," because you have acquired the requisite amount of mechanical proficiency to enable you to time the ball with the proper degree of accuracy; and the very fact that the ball so seldom deviates from the direct road from wicket to wicket imparts to your play a feeling of confidence which the peculiar gyrations of the ball, as it travels from the arm of a slow bowler, would seriously disturb. You are more likely to score, too, from fast bowling, and that is a feature that you are not likely to forget. One lunge, and you may make a hit for five, because the fieldsmen may happen to be just a foot out of the mark, and the ball travels at too rapid a pace for him to secure it at the right moment. You

know, too, that in pitch the excellence emphatically rests with the slow bowler, as his very action renders him less likely to tire; and to maintain a good pitch in fast bowlers requires a rare amount of muscular power.

You are a medium-paced bowler, then, and you have reached a certain degree of accuracy in your own little sphere. You will have to give your attention now chiefly to studying the special differences that you may happen to note in the play of the several batsmen against whom you are contending. You have already learned to acquire proficiency in the method of delivering the ball, but you have still to discover the best means of applying your talents. You have to use your head, and to pit your perceptive faculties against those of many a different foeman, so that you have yet a lesson which must not be overlooked. In fact, it resolves itself now entirely into a question of *your* brains against those of the batsman, and it is undoubtedly your own fault if you fail to succeed. You will have many varieties of opposition to encounter, so that you will have need of all your discrimination. Beware of experimenting until you have to some extent sounded the depths you are approaching, for the ball that is easy as A B C to one may be the most difficult that you can give to another; and this cannot possibly be discovered until you have gained some idea of the different styles to which you will have to be opposed. See for yourself the various points that a bowler has to study, and you will be able to estimate the difficulties under which he labours. He must be patient, above all things, and not easily disheartened, or he may as well abandon all hope of distinction. You will find few bowlers who can maintain their position the same after being hit for six; but it is essentially this class of resolute players who do become famous, by means of the sheer dogged determination to succeed. You can no more rely on the bowler who collapses because short-slip allows a ball to pass between his legs, or because point, after fanciful contortions, gets so close to the ball as to make the spectators believe that it was a possible catch, than you can on his equally unfortunate fellow, who is a very demon at the practice nets, but the veriest impostor when called upon to display his form in a match.

If you aim at being an absolute expert in the way of bowling, you will have to cultivate other faculties than those with which the mere possession of a certain amount of bodily strength has endowed you. The science of batting has improved so much, and developed so marvellously with the proportionate improvement in the condition of cricket-grounds, that the old order of bowling has changed in a surprising manner, giving place to a new and vastly more intelligent state of things. Indeed, to be a skilful bowler nowadays requires a degree of mental acumen that was almost unnecessary in the past, when village commons were rough, and protective armour had not yet been invented to indemnify the batsman against any serious risks, and make his position at the wickets as pleasant of tenure as possible. You will have more than one style of batsman to meet, so that you must have all your wits about you, to adapt yourself to differing circumstances. You will have to face sometimes a batsman whom no amount of allurements will entice an inch beyond the limits of the popping crease, and at other times members of the "slogging" fraternity will confront you whose eyes are so keen, and shoulders so broad, that even your most cunningly-devised ball will be sent to the next parish. There are some batsmen of this impetuous order who will meet you almost half-way between the wickets.

You will find that practice will soon initiate you into the special weakness of every batsman with whom you have to cope, provided that you only take the trouble to learn, and are gifted with an ordinary amount of discernment. There will occasionally be times when you are punished severely; for it happens that a batsman has his own peculiar likes and dislikes, and your bowling may unfortunately come under the former category. You may have tried every *ruse*

common to the general run of bowlers, and without success. You have varied your pitch with consummate care, but still the play of the batsman has been varied too. You have altered your tactics then, and made the ball point from off to leg, instead of from leg to off, but with the same ill-fortune; and your artifices seem to be divined by intuition. In the light of a last hope, you have then determined to give a ball that shall be utterly devoid of break or spin, and it has sped straight from your arm into the wicket of your foeman. You have always a material advantage over your adversary, in that he has at the most only a few seconds to deliberate on his movements, while you may have, in addition, a great help in any inequality of ground.

If you are wise, you will not continue to bowl when you have found that the batsman has thoroughly mastered you, but take a spell of rest, and return invigorated to the attack. Such a course will involve some self-sacrifice, for the best bowlers will feel aggrieved at being taken off, even when they are practically ruining their side. It is common enough to hear such a one complain of being so treated, and for this of all reasons that he felt certain he would secure a wicket in an over or two!

You must be cautious, above all things, to keep your bowling well up to the batsman, or your chances will be very scarce. It may be that now and then you suffer, but on the other hand you are little likely to do any great injury to the bat, unless you do preserve something more than a short pitch in your bowling. Remember that you have ten men to help you in the field, and that you have to consider them as much as, or even more, than yourself. The perfect condition of cricket-grounds nowadays, and the almost painful regularity that marks the course of each ball after the pitch, is very much against your chance of hitting the stumps themselves, so that you must utilise your forces as best you can. A far-pitched ball, or what is technically called a "yorker," will often secure the fall of an experienced batsman, before he has been in long enough to get his eye used to the sight, when thousands of short-pitched balls would be treated with contempt. Indeed, with short-pitched balls you lose altogether the great point of vantage that you have over the batsman, in giving him plenty of time to speculate on and determine his movements. Scores of fast bowlers, useful enough when the ground is rough, and the ball flies almost perpendicularly from the pitch, are practically valueless on a good and easy wicket, solely because their pitch is so short that every ball comes up easily to the bat, and is hit without difficulty, or so far from the point aimed at it, that it goes an inch or two over the stumps, instead of striking them.

You will learn, in course of time, that the very best batsman has his vulnerable place. You will discover that few are without some form of weakness, especially with balls pitched on the leg stump; and this is essentially the blind side, the most favourable for you to attack, if you are able to maintain anything like a continuous fire. Here, though, you must be very careful not to overdo matters by pitching the ball too near the bat, for it is decidedly easier to get rid of a ball well up on the leg stump than one of a lesser pitch. A short-pitched ball, straight on the leg stump, is the most difficult of all for the batsman, as it is the most likely to produce a catch. You will do well to experiment on this ground, for, as a general rule, the tendency to straight play is overcome by a succession of leg balls, and the patience of the batsman is exhausted, until he begins to show, not only signs of a crooked bat, but a desire to hit, whereupon he is inevitably lost. If you find that your opponent has a strong defence, that he plays straight, and is at all stiff or cramped in style, do not maintain a persistent attack at his stumps, but rather tempt him, and encourage him to forsake his prudential tactics. If you have tried him on the off side, and discover that he can hit well in that quarter, or can cut well, as most systematic blockers can,

give him one on the leg stump, and dispose the field, whom you have stationed at short leg, according to the manner in which he meets the new assault. You can do much in all probability by this simple ruse, for a good field at short leg will still more effectively tramp the movements of the bat; and if he be at all worthy of his onerous post, will be able to adapt himself as well to the requirements of the ball, and help materially the aim of the bowler.

You must remember, too, that you have to rely *greatly on the assistance* that you derive from the ten players who combine to constitute your field, so you will have to be cautious that you dispose them rightly, and that you work harmoniously with them, or you will be a serious loser yourself. If you are in good accord with them, you will find many a catch made that would otherwise perhaps never have been attempted.

Bowl always with the idea of getting a wicket, not of accomplishing another maiden over. Do not make excuses when you are asked to bowl, that it is not your day, or that the wind is too strong, that the hill is against you, or the ground too heavy for you to stand. Sink all such insignificant devices, and play the game as if it were a noble sport, instead of a mere vehicle for individual aggrandisement.

FIELDING.

In the majority of elementary treatises which have been written on Cricket, there has been little or no allusion made to fielding, which is certainly one of the most important qualifications in a good cricketer. A good bat may be unluckily caught, and a good bowler may not be on the spot for the day; and then, if bad men be in the field, they become mere clogs upon the other men on their side, and do more harm than good. It is not, therefore, by any means a waste of time on the part of a youthful cricketer if he steadily sets to work and learns his duties in the field, by carefully watching the movements of masters in the art. It must be borne in mind, however, that fielding is not, like many simpler things, picked up in one or two days, a perfect apprenticeship must be served, and the assistance of a quick eye and steady nerve must be enlisted on the tyro's side to bring about success.

Before going through the various places in the field at which glory can be gained, and reputations made, it may be as well to give a few hints upon fielding in general, as they may be useful to beginners. In the first place, it will be universally admitted that the primary object of a man standing at any place is to catch the batsman out or to save runs. But even with this laudable object in view, it is strange to see the awkward manner in which many so-called cricketers set about the task. Often in the case of a high catch they hurry up to the ball in a state of excitement, which prevents them from taking a steady look at it, and judging it properly. Their legs straddle under them, and their hands are wide apart. Holding a catch in such a position is only a matter of chance, and it is frequently the case that the lucky fieldsman is even more astonished at his success than the lookers-on. A golden rule for catching high hits is to get as well under the ball as possible, and judge where you think the ball will pitch. Keep your wrists almost together on a level with the lower part of your chest, but a little distance away from it, with the palms of your hands facing each other, and the tips of the fingers upwards, and about eight inches apart. By

Fig. 11.—CATCHING.

this means you will have a sort of box to catch the ball in, and the position of your hands will give you a chance of hugging it to your body, if you do not catch it clean, and the ball tries to elude your grasp (Fig. 11). In the case of sharp catches, quickness of eye alone is of avail, and there is generally little time to make elaborate preparations. It therefore necessitates a field near the wickets keeping a very sharp look-out, or the chance will have been given and missed, before he fairly knows anything about it.

Backing up the wicket-keeper, or the bowler, or another field, in cases where the ball is thrown in, or hit to them sharply, is the bounden duty of the careful field, and a conscientious carrying out of this work has saved many a match from being lost. It is not by any means necessary for a field to wear himself out by too great exertions, and running after another man's ball; but the virtue of backing up should never be lost sight of.

The last important point in fielding is throwing-in to the wicket-keeper, and many a good field in other respects is simply a nuisance to his side from the

carelessness of his throwing-in. On all occasions the ball should be thrown in as low as possible, provided it does not roll along the ground, but reaches the wicket-keeper in one or two hops. The perfection of throwing-in consists in sending in the ball without any spin on it, about six inches above the bails, and in one hop. Of course this is not always possible, but still many fieldsmen manage to do it pretty often. There is no necessity for throwing-in with all one's might, when men are not running, or even if they are, when there is plenty of time to get them out. A violent "peg at the wickets" is always foolish, and frequently results in an overthrow, whilst a soft

Fig. 12.—THE WICKET-KEEPER (TAKING A LEG-BALL).

return when a hard one is not necessary is an act of consideration to the wicket-keeper, whose hands are often tender from bruises gained at his post.

The most important places in the field are, after bowler, those of wicket-keeper, long-stop, point, cover-point, and long-leg; but there is no place where a good man is not sure to come to the front and distinguish himself if he simply takes pains to do so, and so once more the tyro must bear in mind that he has only himself to blame if he neglects the practice which alone can make him perfect.

The *wicket-keeper* has not only an honourable but a dangerous position, for he is often injured by a quickly-rising ball which he miscalculates. The art in wicket-keeping is to "take" leg-balls well, and this is quite impossible if a correct position is not assumed. To enable him to take a leg-ball the left foot should not be placed in front of the right one, but about one foot behind it, and about three feet apart from it (Fig. 12). By placing the right foot near the wicket, and with his legs in this position, the wicket-keeper, when he stoops down, can watch the progress of the ball with ease, and is able to "take it" if it comes near enough to him without changing the position of his feet to any great degree. A wicket-keeper must have a good eye and a good temper, and should be above making perpetual appeals to the umpire on frivolous grounds, a habit which only makes the latter suspicious of him when a genuine appeal is made.

Point is a position requiring a quick eye and steady nerve as well. He should stand almost on a level with the wicket for fast bowling, but get nearer the bowler for slow bowling. He should not, however, run in needlessly. He should not stand in closer than he can see clearly.

Cover-point stands farther from the wicket than point, and has almost similar duties to perform. He must bear in mind that there is a tendency in balls coming to him to break towards slip after they touch the ground.

Long-Stop's place is behind the wicket-keeper, and his duty is to prevent byes from being gained.

Long-Leg has often the hardest place in the field for overs at a time, and the variety of different styles in hitting to leg always makes his situation an anxious one. He should be placed square with the wicket, or even in front of it for slow bowling, and move his position in the direction of the long-stop, in proportion to the increase of a bowler's pace. There is a break on the balls received at long-leg towards long-stop which must be allowed for.

Long-Slip, too, has a break on the balls he receives, and this, like Cover-point's, is towards the long-stop.

Short-Leg has also a break, and his, like Long-leg's, is in the direction of the long-stop. His position in the field must be regulated by the bowler's pace.

Changes have to be made in a field when left-handed batsmen appear at the wicket. It is then usual for point and short-leg to occupy each other's places, which obviates the constant passing to and fro of these fieldsmen every time a run is scored. The other men usually alter their positions in like manner to suit the circumstances of the case, but the umpire at the batsman's end always crosses over and stands in a line with the crease near short-leg.

The duties of an *Umpire* are to decide upon all disputed questions of catching, stumping, or running out. In cases of catches the umpire at the bowler's end is the one to decide, and in stumping the one at the batsman's end. In running out cases the appeal is of course made to the umpire at the end where the wickets are put down. The umpire has also to keep a record of the balls bowled in each over, and to call "Over" when the number agreed upon has been bowled. It may be remarked that they usually keep their reckoning straight by holding a number of coins in one hand at the commencement of the over, which are passed singly from one hand to the other as each ball is bowled; when all the coins have changed hands "Over" is called. The umpire has also to call "No ball" or "Wide" when it is bowled (these do not count in the over as balls). In the case of the ball striking a player's person and not his bat, and a run being scored, it is a leg-bye, and not an ordinary bye; this the umpire communicates to the scorer.

The *Scorers* are generally two in number, and their duties are to record the runs obtained, on specially designed scoring sheets. In many cases what is termed an analysis of the bowling is also kept, and this consists of a record of every ball bowled, and the fate that befel it. It is usual to signify a ball that no run is scored off by a dot, and one that is scored off by a figure representing the number scored, and one that takes a wicket by a big W (Fig. 13).

BOWLER'S NAME.									
Jones ... ..	.	3	w.	1	.	.			
	1	2	.	W	.	.			
Smith ... ..	.	.	n.b.	1					
					

Fig 13.—A BOWLING ANALYSIS.

From this diagram it will be seen that Jones has bowled three overs; the first produced 6 runs—viz., 3 from the second ball, 1 from the fourth, and 2 from

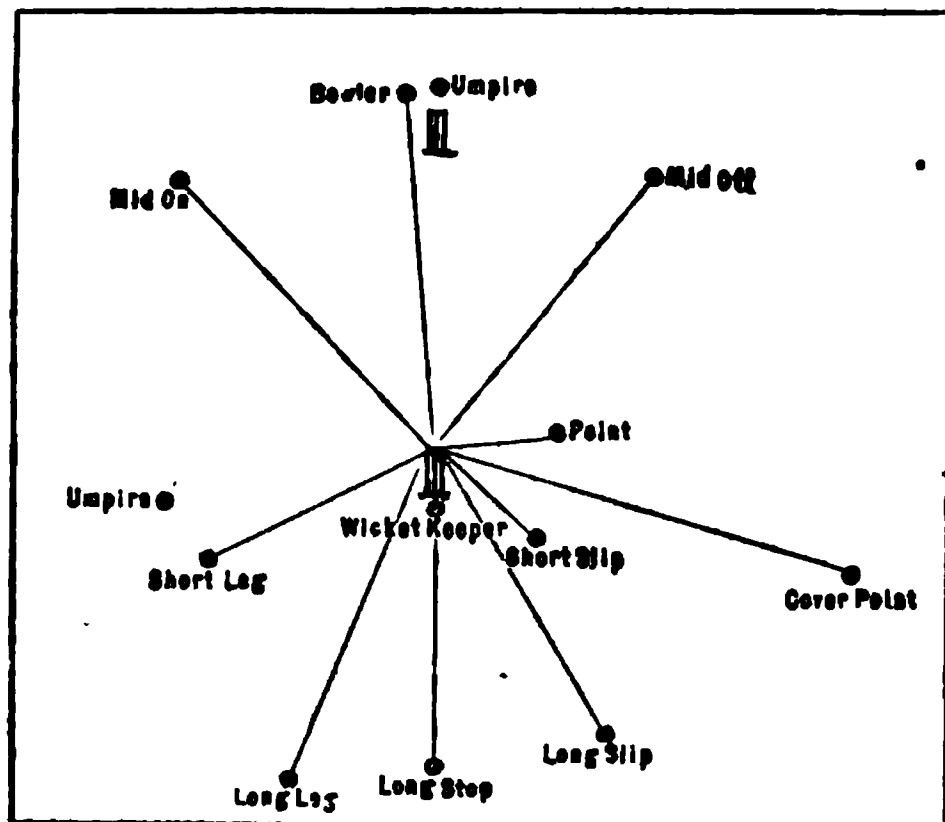


Fig. 14.—FIELD SET FOR FAST BOWLING.

the fifth. His second over commenced with a wide (marked by a small w), off the second ball no run was made (this is practically the first of the five balls forming the over), then 1 run, then two dots, then a wicket. His third over is a "maiden," no runs being scored. Smith opens with a maiden; the first ball of his second over is a no-ball, from the second no run is scored, the third is hit for one; from the remaining three balls neither runs nor wickets are obtained. Wides and no-balls do not count in reckoning an over, so that in a five-ball over, a bowler who sends down a wide has to bowl six balls to that over. The

state of the game is usually communicated by the scorers to the public and those concerned by means of what is called a "telegraph." This consists of a black-board or frame raised some feet above the ground; on this are three rows of hooks, three hooks being on the top and bottom rows, and two on the middle; on these hooks metal numbers are hung, which show the state of the game. The top row shows the total score, the middle gives the number of wickets down; the bottom tells the runs scored by the last man out. It is customary to change the top line every ten runs, and always to re-arrange it on the fall of a wicket. The "telegraph" should be diligently attended to, for when left to be looked after by anybody, it is usually neglected altogether, and is really in such cases of no use. This kind of slovenliness is by no means rare.

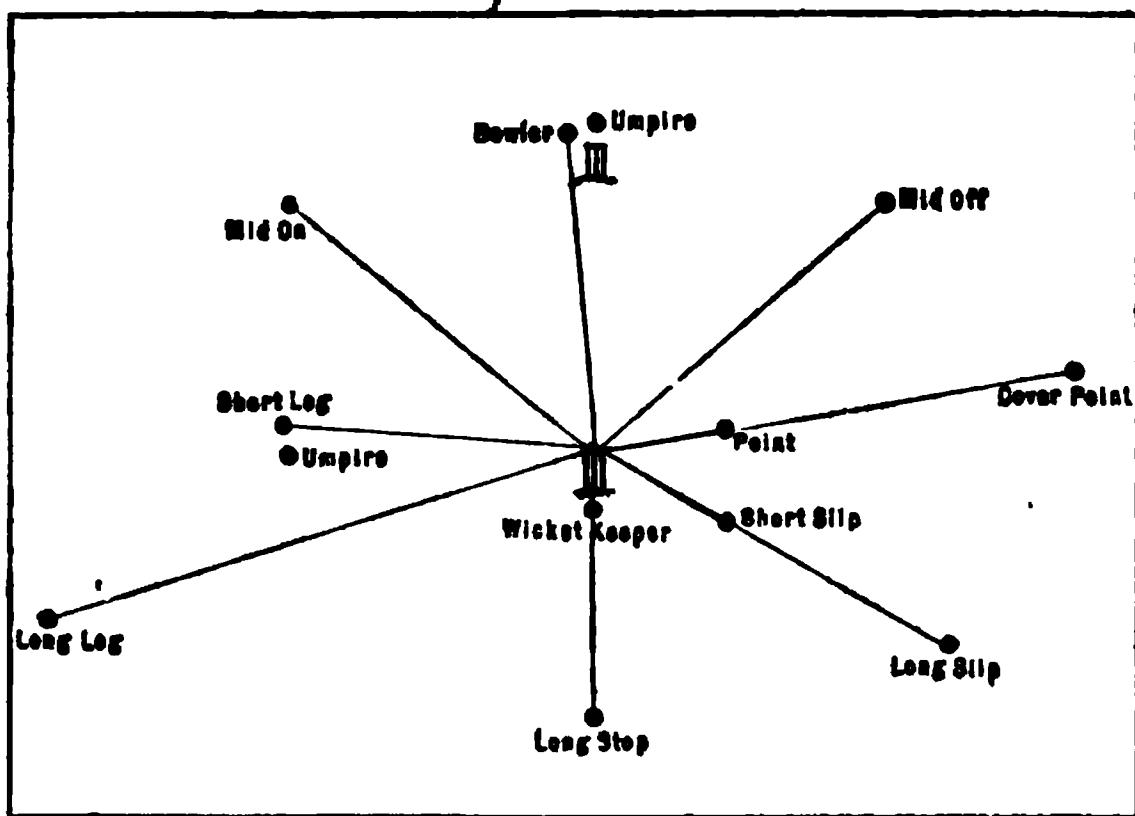


Fig. 15.—FIELD SET FOR MEDIUM BOWLING.

The places in the field being dependent on the bowler's peculiarities, we give plans which represent the disposition of the field in fast (Fig. 14),

medium (Fig. 15), and slow (Fig. 16) bowling. Such arrangements can be modified to meet the requirements of any special case.

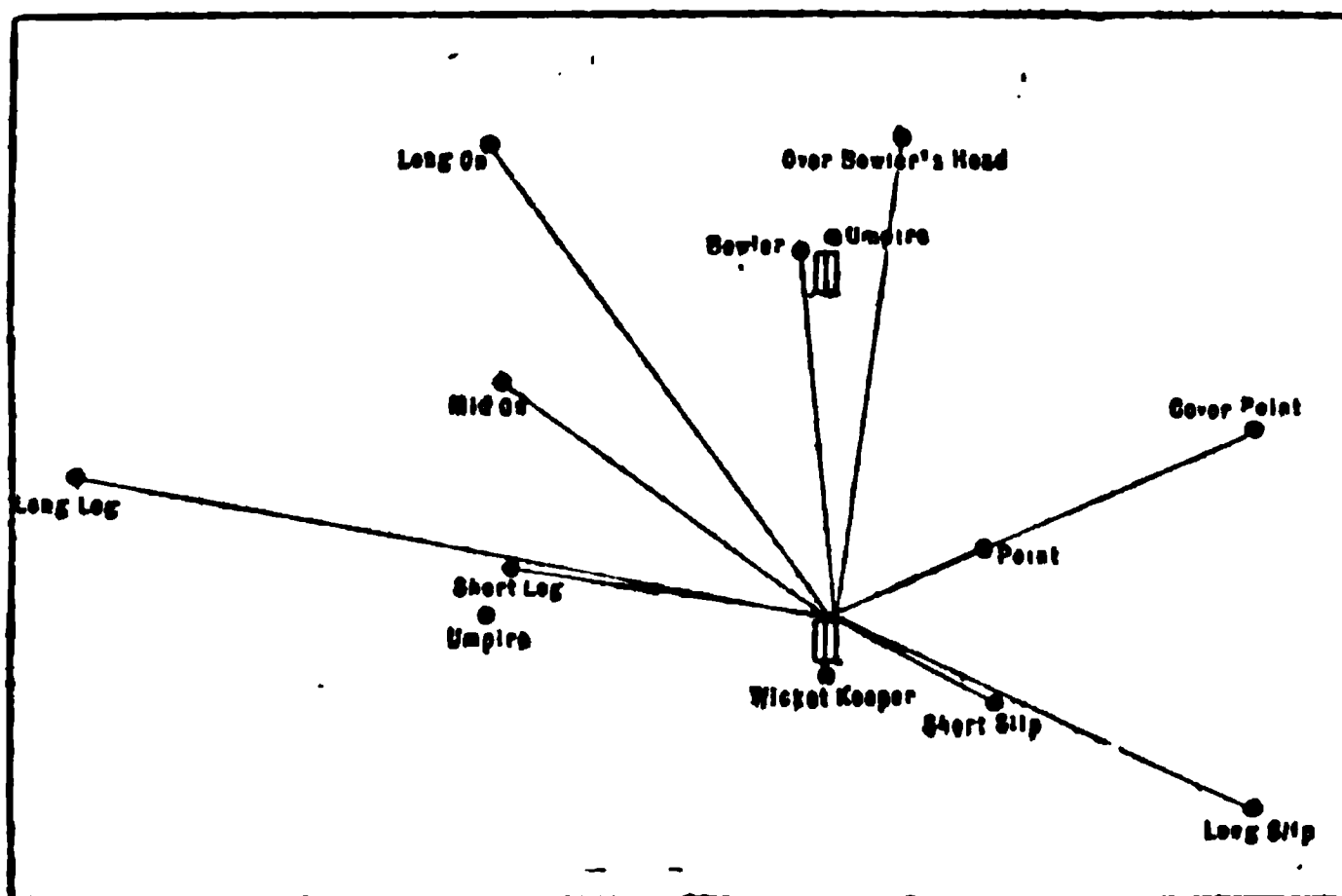


Fig. 16.—FIELD SET FOR SLOW BOWLING.

THE LAWS OF CRICKET, AS REVISED BY THE MARYLEBONE CLUB.

1.—**The Game.** A match is played between two sides of eleven players each, unless otherwise agreed to; each side has two innings, taken alternately, except in the case provided for in Law 53. The choice of innings shall be decided by tossing.

2.—**Runs.** The score shall be reckoned by runs. A run is scored:—

1st. So often as the Batsmen after a hit, or at any time while the ball is in play, shall have crossed, and made good their ground, from end to end.

2nd. For penalties under Laws 16, 34, 41, and allowances under 41.

Any run or runs so scored shall be duly recorded by scorers appointed for the purpose.

The side which scores the greatest number of runs wins the match. No match is won unless played out or given up, except in the case provided in Law 45.

3.—**Appointment of Umpires.** Before the commencement of the match two Umpires shall be appointed; one for each end.

4.—**The Ball.** The Ball shall weigh not less than five ounces and a half, nor more than five ounces and three-quarters. It shall measure not less than nine inches, nor more than nine inches and one-quarter in circumference. At the beginning of each innings either side may demand a new ball.

5.—**The Bat.** The Bat shall not exceed four inches and one-quarter in the widest part; it shall not be more than thirty-eight inches in length.

6.—**The Wickets.** The wickets shall be pitched opposite and parallel to each other at a distance of twenty-two yards. Each wicket shall be eight inches in width, and consist of three stumps, with two balls upon the top. The stumps shall be of equal and sufficient size to prevent the ball from passing through, twenty-seven inches out of the ground. The balls shall be each four inches in length, and when in position, on the top of the stumps, shall not project more than half-an-inch above them. The wickets shall not be changed during a match, unless the ground between them become unfit for play, and then only by consent of both sides.

7.—**The Bowling Crease.** The Bowling Crease shall be in a line with the stumps: six feet eight inches in length; the stumps in the centre; with a Return Crease at each end, at right angles behind the wicket.

8.—**The Popping Crease.** The Popping Crease shall be marked four feet from the wicket, parallel to it, and be deemed unlimited in length.

9.—**The Ground.** The Ground shall not be rolled, watered, covered, mown, or beaten during a match, except before the commencement of each innings and of each day's play, when, unless the In-side object, the ground shall be swept and rolled for not more than ten minutes. This shall not prevent the Batsman from beating the ground with his bat, nor the Batsman nor Bowler from using sawdust in order to obtain a proper foothold.

10.—**The Bowler. No Ball.** The Ball must be bowled; if thrown or jerked, the Umpire shall call "*No Ball.*"

11.—The Bowler shall deliver the ball with one foot on the ground behind the bowling crease, and within the return crease, otherwise the Umpire shall call "*No Ball.*"

12.—**Wide Ball.** If the Bowler shall bowl the ball so high over or so wide of the wicket that in the opinion of the Umpire it is not within reach of the Striker, the Umpire shall call "*Wide Ball.*"

13.—**The Over.**—The Ball shall be bowled in Overs of five balls from each wicket alternately. When five balls have been bowled, and the ball is finally settled in the Bowler's or Wicket-keeper's hands, the Umpire shall call "*Over.*" Neither a "*No Ball*" nor a "*Wide Ball*" shall be reckoned as one of the "*Over.*"

14.—The Bowler shall be allowed to change ends as often as he pleases, provided only that he does not bowl two overs consecutively in one innings.

15.—The Bowler may require the Batsman at the wicket from which he is bowling to stand on that side of it which he may direct.

16.—**Scoring off No Balls and Wide Balls.** The Striker may hit a "*No Ball,*" and whatever runs result shall be added to his score; but he shall not be out from a "*No Ball,*" unless he be run out or break Laws 26, 27, 29, 30. All runs made from a "*No Ball,*" otherwise than from the bat, shall be scored "*No Balls,*" and if no run be made one run shall be added to that score. From a "*Wide Ball*" as many runs as are run shall be added to the score as "*Wide Balls,*" and if no run be otherwise obtained one run shall be so added.

17.—**Bye.** If the ball, not having been called "*Wide*" or "*No Ball,*" pass the Striker, without touching his bat, or person, and any runs be obtained, the Umpire shall call "*Bye;*" but if the ball touch any part of the Striker's person (hand excepted), and any run be obtained, the Umpire shall call "*Leg Bye,*" such runs to be scored "*Byes,*" and "*Leg Byes,*" respectively.

18.—**Play.** At the beginning of the match, and of each innings, the Umpire at the Bowler's wicket shall call "*Play;*" from that time no trial ball shall be allowed to any Bowler on the ground between the wickets, and when one of the Batsmen is out, the use of the bat shall not be allowed to any person until the next Batsman shall come in.

19.—**Definitions.** A Batsman shall be held to be "*out of his ground,*" unless his bat in hand or some part of his person be grounded within the line of the Popping Crease.

20.—The wicket shall be held to be "*down,*" when either of the bails is struck off, or, if both bails be off, when a stump is struck out of the ground.

The STRIKER is out—

21.—**The Striker.** If the wicket be bowled down, even if the ball first touch the Striker's bat or person;—"*Bowled.*"

22.—Or, if the ball, from a stroke of the bat or hand, but not the wrist, be held before it touch the ground, although it be hugged to the body of the catcher;—"*Caught.*"

23.—Or, if in playing at the ball, provided it be not touched by the bat or hand, the Striker be out of his ground, and the wicket be put down by the Wicket-keeper with the ball or with hand or arm, with ball in hand;—"*Stumped.*"

24.—Or, if with any part of his person he stop the ball, which in the opinion of the Umpire at the Bowler's wicket shall have been pitched in a straight line from it to the Striker's wicket and would have hit it;—"*Leg before Wicket.*"

25.—Or, if in playing at the ball he hit down his wicket with his bat or any part of his person or dress;—"*Hit Wicket.*"

26.—Or, if under pretence of running, or otherwise, either of the Batsmen wilfully prevent a ball from being caught;—"*Obstructing the field.*"

27.—Or, if the ball be struck, or be stopped by any part of his person, and he wilfully strike it again, except it be done for the purpose of guarding his wicket, which he may do with his bat, or any part of his person, except his hands;—"*Hit the ball twice.*"

Either BATSMAN IS OUT—

28.—**The Batsmen.** If in running, or at any other time while the ball is in play, he be out of his ground, and his wicket be struck down by the ball after touching any Fieldsman, or by the hand or arm, with ball in hand, of any Fieldsman;—"*Run out.*"

29.—Or, if he touch with his hands or take up the ball while in play, unless at the request of the opposite side;—"*Handled the ball.*"

30.—Or, if he wilfully obstruct any Fieldsman;—"*Obstructing the field.*"

31.—If the Batsmen have crossed each other, he that runs for the wicket which is put down is out; if they have not crossed, he that has left the wicket which is put down is out.

32.—The Striker being caught, no run shall be scored. A Batsman being run out, that run which was being attempted shall not be scored.

33.—A Batsman being out from any cause, the ball shall be "*Dead.*"

34.—**Lost Ball.** If a ball in play cannot be found or recovered, any Fieldsman may call "*Lost Ball,*" when the ball shall be "*dead;*" six runs shall be added to the score; but if more than six runs have been run before "*Lost Ball*" has been called, as many runs as have been run shall be scored.

35.—After the ball shall have been finally settled in the Wicket-keeper's or Bowler's hand, it shall be "*dead;*" but when the Bowler is about to deliver the ball, if the Batsman

at his wicket be out of his ground before actual delivery, the said Bowler may run him out; but if the Bowler throw at that wicket and any run result, it shall be scored "No Ball."

36.—A Batsman shall not retire from his wicket and return to it to complete his innings after another has been in, without the consent of the opposite side.

37.—Substitute. A substitute shall be allowed to field or run between wickets for any player who may, during the match, be incapacitated from illness or injury, but for no other reason, except with the consent of the opposite side.

38.—In all cases where a substitute shall be allowed the consent of the opposite side shall be obtained as to the person to act as substitute, and the place in the field which he shall take.

39.—In case any substitute shall be allowed to run between wickets, the Striker may be run out if either he or his substitute be out of his ground. If the Striker be out of his ground while the ball is in play, that wicket which he has left may be put down and the Striker given out, although the other Batsman may have made good the ground at that end, and the Striker and his substitute at the other end.

40.—A Batsman is liable to be out for any infringement of the Laws by his substitute.

41.—The Fieldsman. The Fieldsman may stop the ball with any part of his person, but if he wilfully stop it otherwise, the ball shall be "dead" and five runs added to the score; whatever runs may have been made, five only shall be added.

42.—Wicket-keeper. The Wicket-keeper shall stand behind the wicket. If he shall take the ball for the purpose of stumping before it has passed the wicket, or, if he shall incommode the Striker by any noise, or motion, or if any part of his person be over or before the wicket, the Striker shall not be out, excepting under Laws 26, 27, 28, 29, and 30.

43.—Duties of Umpires. The Umpires are the sole judges of fair or unfair play, of the fitness of the ground, the weather, and the light for play: all disputes shall be determined by them, and if they disagree, the actual state of things shall continue.

44.—They shall pitch fair wickets, arrange boundaries where necessary, and the allowances to be made for them, and change ends after each side has had one innings.

45.—They shall allow two minutes for each Striker to come in, and ten minutes between each innings. When they shall call "Play" the side refusing to play shall lose the match.

46.—They shall not order a Batsman out unless appealed to by the other side.

47.—The Umpire at the Bowler's wicket shall be appealed to before the other Umpire in all cases except in those of stumping, hit wicket, run out at the Striker's wicket, or arising out of Law 42, but in any case in which an Umpire is unable to give a decision, he shall appeal to the other Umpire, whose decision shall be final.

48.—If the Umpire at the Bowler's end be not satisfied of the absolute fairness of the delivery of any ball, he shall call "No Ball."

48a.—The Umpire shall take especial care to call "No Ball" instantly upon delivery; "Wide Ball" as soon as it shall have passed the Striker.

49.—If either Batsman run a short run, the Umpire shall call "One Short," and the run shall not be scored.

50.—After the Umpire has called "Over," the ball is "dead," but an appeal may be made as to whether either Batsman is out; such appeal, however, shall not be made after the delivery of the next ball, nor after any cessation of play.

51.—No Umpire shall be allowed to bet.

52.—No Umpire shall be changed during a match, unless with the consent of both sides, except in case of violation of Law 51; then either side may dismiss him.

53.—Following Innings. The side which goes in second shall follow their innings, if they have scored eighty runs less than the opposite side.

54.—On the last day of a match, and in a one day match at any time, the In-side may declare their innings at an end.

ONE DAY MATCHES.

1.—The side which goes in second shall follow their innings if they have scored 60 runs less than the opposite side.

2.—The Match, unless played out, shall be decided by the First Innings. Prior to the commencement of a match it may be agreed:—that the Over consist of 5 or 6 balls.

SINGLE WICKET.

The Laws are, where they apply, the same as the above, with the following alterations and additions:—

1.—One wicket shall be pitched, as in Law 6; with a Bowling Stump opposite to it, at a distance of twenty-two yards. The bowling crease shall be in a line with the bowling stump; and drawn according to Law 7.

2.—When there shall be less than five Players on a side, bounds shall be placed twenty-two yards each in a line from the off and leg stump.

3.—The ball must be hit before the bounds to entitle the Striker to a run, which run cannot be obtained unless he touch the bowling stump or crease in a line with his bat, or some part of his person, or go beyond them, and return to the popping crease.

4.—When the Striker shall hit the ball, one of his feet must be on the ground behind the popping crease, otherwise the Umpire shall call "No Hit," and no run shall be scored.

5.—When there shall be less than five Players on a side, neither Byes, Leg Byes, nor Overthrows shall be allowed, nor shall the Striker be caught out behind the wicket, nor stumped.

6.—The Fieldsman must return the ball so that it shall cross the ground between the

wicket and the bowling stump, or between the bowling stump and the bounds; the Striker may run till the ball be so returned.

7.—After the Striker shall have made one run, if he start again he must touch the bowling stump or crease, and turn before the ball cross the ground to entitle him to another.

8.—The Striker shall be entitled to three runs for lost ball, and the same number for ball wilfully stopped by a Fieldsman, otherwise than with any part of his person.

9.—When there shall be more than four Players on a side there shall be no bounds. All Hits, Byes, Leg Byes, and Overthrows shall then be allowed.

10.—There shall be no restriction as to the ball being bowled in Overs, but no more than one minute shall be allowed between each ball.

The Marylebone Cricket Club (the M.C.C., as it is generally styled) is the supreme legislative assembly for devotees of the willow. Its laws are universally accepted, though in some minor particulars a certain amount of latitude is allowed.

In concluding this article on Cricket, we would most earnestly insist upon the supreme importance of discipline. A club which is weak in this respect does not possess the essential elements of stability, even though in batting or bowling it should be exceptionally strong. Composed, as it commonly is, of players who have perhaps never met before, and who possibly do not see anything of each other during the week, a club ought to be captained by a member whose knowledge of the game, and of the individual capacities of his fellow-members, is thorough, but who, in addition to these important requisites, is able to secure the undoubted respect of his club. A cricketer who is domineering, unsocial, haughty, mean, unsympathetic, may be an admirable player, but will never make a good captain. The captain's responsibilities in the field are very grave. He must be quick to discern how his bowlers, and the batsmen to whom they are opposed, are getting on. He must not hesitate to change the bowling whenever it has "ceased to pay," and when he himself takes the ball in hand, he must have the courage to take himself off with the same promptitude as he would another, in the event of his not being on the spot. Judgment and foresight, as well as tactical skill, are imperatively demanded of every captain. How very absurd it is to change the bowling many minutes after the alteration ought to have been made! In these minutes mischief may have been done beyond recall. The notion prevails in some quarters that the captain sets the field; within limits this is permissible, but the bowler must *always* be allowed to place the men to suit his bowling. So much for the leader of a club. To the members we have only to say that they must render unhesitating obedience to their captain. Even in cases where it is all but conclusive that his instructions are injudicious, they should nevertheless be carried out—though in such an extreme case as this representation of his error may fairly be made to the captain.

Cricket offers not only the most healthful recreation to players, but presents to those who know the game one of the most pleasant means of spending their leisure hours in the open air. In a moral aspect, no game stands higher, and we sincerely hope that our readers may long be spared to take an active delight in this noble pastime.

FOOTBALL.

AMONG all the games dear to the heart of every schoolboy, Football assuredly occupies a pre-eminent position, though some might be disposed to assign the supremacy to that most generally popular of English sports—Cricket. For Cricket is the game for the many—the many of all ages, from the boy who has only just attained to the dignity of knickerbockers, to the man who is already past his prime: while Football is the game for the few—the young, and strong, and vigorous—and to those how dear it is! Was there ever a football-player yet who was not enthusiastic about the sport? and has there ever lived one who has not gloried in the hacks and bruises which are so certain to result from a well-fought game? The statement once made, that Waterloo was won in the playing fields at Eton, was no absurdly exaggerated one, for the grand old English games, and Football particularly, are admirably calculated to engender those sterling qualities which have won for British soldiers so many hardly-contested fights—the pluck to face any odds and any danger; the determination to win, if victory be only remotely possible; the energy and decision impelling action exactly at the right minute; the hardy self-confidence that never even knows when it is beaten, and can scarcely be brought to recognise the possibility of defeat. Pluck and endurance, presence of mind, thorough unselfishness, and a cool disregard of danger, are indeed fully as important qualities in a good football-player, as strength and suppleness of limb, quickness of eye, and speed and nimbleness of foot; and he who loves the game is sure to develop the former qualities (if he have them not already), and to retain them all through his after career.

Football is undoubtedly one of the oldest of English sports, and was apparently very popular as early as the fourteenth century, although we have no description of the game as then played. Some historians would go much further into the past than this, and trace our modern Football back to games played two thousand years ago by the Greeks and Romans. But speculations of this sort can have but little interest to the football-player, who will probably be content to know that the game was certainly played in England in Edward III.'s reign (when its practice was forbidden, as proving detrimental to the welfare of archery, then the first and foremost of English amusements), and that it was mentioned by such early writers as Chaucer, Barclay, and Shakspeare. Thus Barclay in his "Ship of Fools," published in 1509, says:—

"The sturdie plowman, lustie, strong, and bold,
Overcometh the winter with driving the foote-ball,
Forgetting labour and many a grievous fall."

And Shakspeare, in his "Comedy of Errors," shows that in his time a leather ball was certainly in use, for he makes Dromio of Ephesus say—

"Am I so round
That like a football you do spurn me thus?
You spurn me hence, and he will spurn me hither:
If I last in this service, you must case me in leather."

But Football in the olden time differed very much from the game now in vogue; *then* town was matched against town, village against village, and all the able-bodied inhabitants of the rival places usually took part in the contest. The goals were often miles apart, and generally consisted of natural objects, such as brooks or bridges; and the game was, as might be expected, of a very rough-and-

ready description, with little science or skill in it, the ball being kicked or carried at will by the players, in their endeavours to lodge it in the desired goal. The game thus played was a special feature of Shrove-tide in the midland counties not many years ago, and still lingers in one or two old towns and villages in England and Scotland, making its appearance on certain special days of the year.

The old-fashioned game, played without any recognised rules, and successively condemned by various monarchs on account of its roughness and brutality, appears in the course of time to have been brought within bounds at the public schools, and dignified with the possession of codes of rules. Unfortunately these rules differed at the various schools—each school cherishing its own peculiar code as sacred, and objecting to any alteration—and this want of uniformity militated seriously against the popularity of the game. Thus Eton differed from Harrow, and Harrow from Rugby; while Winchester, Uppingham, Shrewsbury, and Marlborough all had their peculiar styles of play. What a grand description of a hard-fought fight is that in “*Tom Brown’s School Days*”! but then, where else than at Rugby was the game so played? It seemed, indeed, as if this lack of uniformity would prevent Football from ever taking its true place as a national sport, and the early attempts to overcome the difficulty were not very successful, every clique clinging with affection to the game of its youth, time-honoured with school tradition. Later efforts were, however, attended with a better fortune, and ultimately resulted in the establishment of two great associations of Football clubs in all parts of Great Britain and Ireland—the Rugby Union and the Football Association—each of which drew up a code of rules by which the game should be governed. Earnest endeavours were at one time made to amalgamate these two associations, but the styles of play of each were so diametrically opposed, that it was found utterly impossible to arrive at a common understanding. One or other, however, of these codes of rules is now recognised by almost all football-players, special exception being made for two or three of the public schools—such as Eton, Harrow, and Uppingham—which still retain some of their old peculiarities. In both of the recognised Football codes the object of each team of players is to force the ball towards their opponents’ goal; but this is almost the only important point in which they agree, for the number of players is different, the shape of the balls is dissimilar, the styles and rules of play vary greatly, the field of play and the goal-posts are not alike, and while in the Rugby Union game the ball is kicked over the cross-bar in order to obtain a goal, in the Association game it is kicked under. After saying a few words, then, as to the dress required for Football, we shall proceed to give some account of the two games authorised by the Rugby Union and the Football Association.

DRESS.

The most convenient dress for Football consists of a tight-fitting jersey and knickerbockers, and stockings of the same colour as the jersey. Some of the more prominent Association clubs, however, wear a flannel shirt instead of a jersey. This costume is, perhaps, more picturesque, and in the Association game, with its absence of “scrummages,” “mauls,” and “collaring,” its looseness forms no objection. For the Rugby Union game, however, a tight-fitting jersey, affording little, if any, hold to an opponent, is indispensable. But even when wearing a very tight jersey, a player running with the ball will often find himself seized by the neck of the garment; at this spot many jerseys are liable to tear, and for this reason it is generally advisable to have a tape sewed on the inside round the neck. For the Association game moderately thin and light boots should be worn. For the Rugby Union game forward players require strong and comparatively thick boots, as their feet are continually being trampled upon in the scrummages; while “backs” should wear light shoes or boots, so that

their progress may not be impeded when they get a chance of a good run. Players are not allowed to wear iron plates or projecting nails on their boots, since they add so greatly to the force of any kick that may by accident be given to an opponent or friend. Caps are seldom worn by Rugby Union players. It is especially desirable that all the members of a team should be dressed alike, otherwise occasional misapprehension is certain to ensue.

THE RUGBY UNION GAME.

The field of play (Fig. 1) should be a level piece of turf, 110 yards in length between the goal-posts, and 75 yards in width; in cases of necessity these dimensions may be a little less, but they should never be exceeded. The ground should extend behind the posts for about twenty yards, so as to allow space for a run in when the ball is driven behind the goal. A little space is also required beyond the side boundaries, so that a piece of turf about 150 yards in length by 100 yards in width makes a desirable ground. The goals are composed of two upright posts of indefinite height—those of about fifteen feet will be found convenient—joined by a cross-bar ten feet above the ground. Over this cross-bar the ball must be kicked in order to obtain a goal. The posts are placed eighteen feet six inches apart, and on no account should flags be placed on them. The two goals having been fixed at the required distance, lines should be marked on the turf from the side of each goal to the edge of the ground. These mark the limit of the field in point of length, and are represented by the lines A A in the accompanying diagram (Fig. 1). When the ball is on or behind one of these lines, it is "in goal." The sides of the ground should be indicated by lines marked on the turf, and at right angles to the goal, as shown by the lines T T in the diagram. These are known as the *touch-lines*, and when the ball is outside them it is said to be "in touch." The ground that lies in the four corners outside the field of play—that is to say, the space which is both outside the touch lines and behind the goal-line (marked Q in the diagram)—is known as "touch in goal." Flags should be placed at the four corners of the field of play,

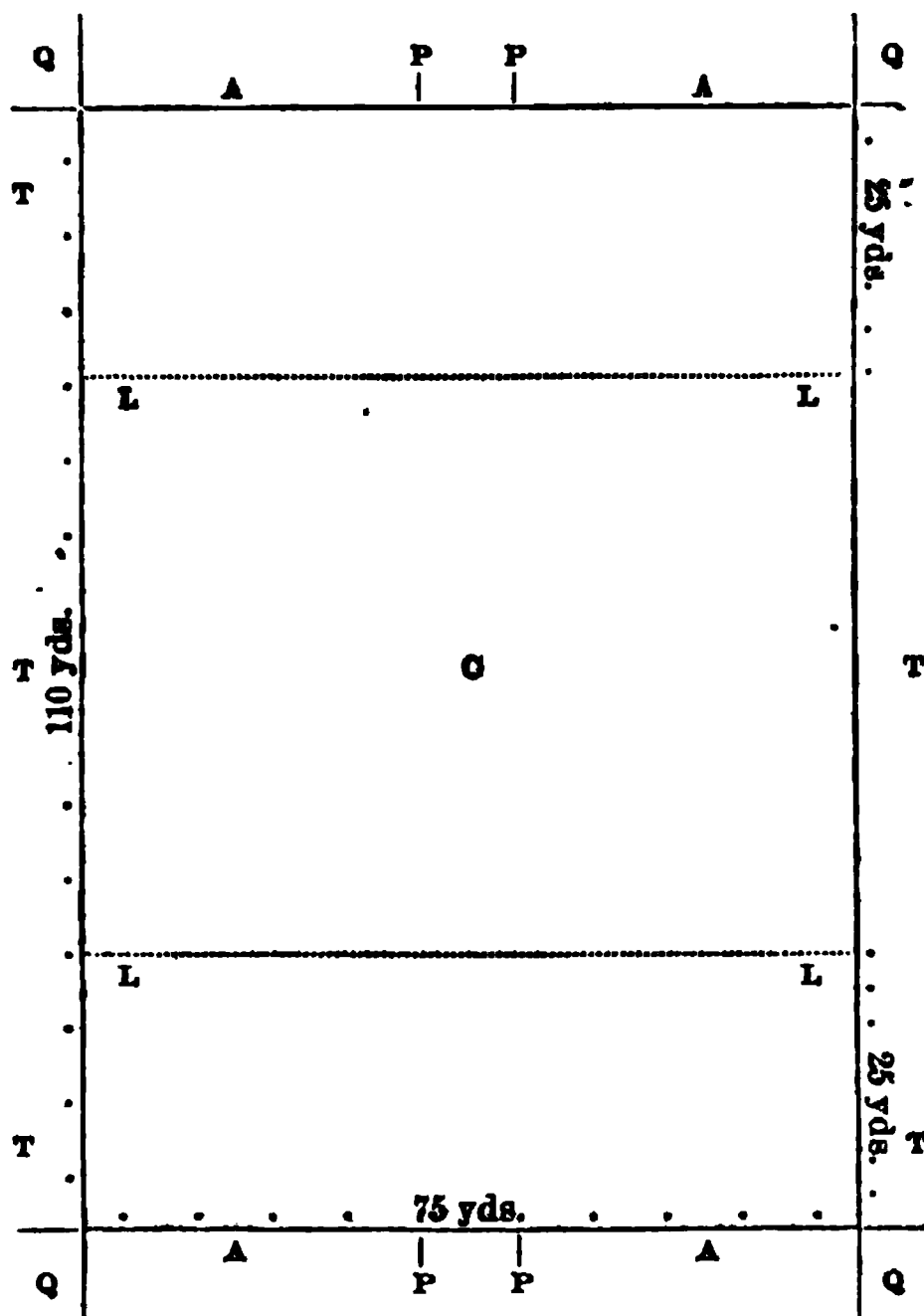


Fig. 1.—PLAN OF THE FIELD FOR THE RUGBY UNION GAME.

AA. Goal Lines.
PP. Goal Posts.
TT. Touch Lines.
LL. Limit for Kick-out.

QQ. Touch in Goal.
C. Centre of Field of Play.

The Touch Lines and Goal Lines should be marked on the turf. The limit for Kick-out should be marked by flags set up in the Touch Lines. Flags should also be posted at the corners of the field of play, and exactly in the centre of each touch line.

and three additional flags are required for each touch-line, one to be placed at each end, at a distance of twenty-five yards from the goal (L L in diagram), to mark the spot from which the defending side must kick the ball out after it has been touched by them in their own goal, or by them or their opponents in "touch in goal;" and one at a spot equi-distant from the two goals (T T in diagram) to mark the half-distance, and in a line with which the ball is kicked off at the com-

mencement of play, at half-time, or when a goal has been obtained by either side.

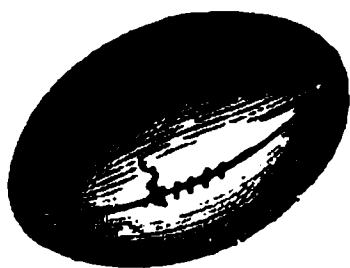


Fig. 2.—THE RUGBY FOOTBALL.

The flag-posts should be six or seven feet in height, so that they may be seen from all parts of the ground, even when players or onlookers are crowding around them. It is, of course, desirable that the flags should show the colours of the school or club to which the ground may belong.

The ball used for the Rugby Union game is egg-shaped (Fig. 2), not round like the Association ball. Length, 11 to 11½ in.; length circumference, 30 to 31 in.; width circumference, 25½ to 26 in.; weight, 13 to 14½ ozs.

The team of players on each side should consist of fifteen men, who should be disposed of by the captain somewhat as follows:—8 or 9 men should be appointed *forwards*, whose duty it is always to follow closely on the ball, and to gather round it when a scrummage has to be formed, that is to say, when the ball is held and cannot be run with. In theory, the forwards should be the heaviest men of the team, as they are required to exert their weight and strength to push the ball through the ranks of their opponents when a scrummage is formed; in practice, however, it will generally be found more convenient to select the six players who are to fill the more important places in the field, and to make all the rest "forwards." Two of the most active men in the team—two who are quick at running, tackling, and above all at *passing*—should be selected as "half-backs." The duty of these last is to be continually on the watch for a chance of running with the ball, or of passing it to one of the "three-quarter-backs," or of preventing any of their opponents from getting away with it. As a rule they should always be a little behind the forwards, unless they seize an opportunity of dashing in front for a run or to tackle an opponent; and when a scrummage is formed, they should stand from three to five yards behind it, and a little to the right or left, according to the position selected by them or assigned to them by the captain of the team at the commencement of the game. It is a matter of great importance that each half-back should keep the same side all through the play—that is, that he should always play on the same side of the scrummage, and keep throughout, as far as possible, on that side of the ball; otherwise both half-backs will continually be rushing together after the ball, and much confusion will result. A short distance behind the half-backs, should be 3 or 4 "three-quarter-backs"—the speediest men in the team, and the best at running, dodging, and tackling; two of these should stand rather wide of the play, one on each side, and one in the centre, directly in a line with the scrummage. Three-quarter-backs should be good "drop-kicks" (Fig. 3)—men who can make a drop-kick* with either foot—as they will often have a chance of kicking a goal direct from the field of play. About fifteen yards or so behind the three-quarter-backs, in the centre of the ground, should be a full "back," the last resource of his side in the event of an opponent carrying the ball through the other players. The

* A "drop-kick," or "drop," is made by letting the ball fall from the hands and kicking it the very instant it rises. In this respect it differs from an ordinary kick made while the ball is rolling on the ground; from a "place-kick," made by kicking the ball after it has been placed in a nick in the ground prepared in order to keep it at rest; and from a "punt," made by letting the ball fall from the hands and kicking it *before* it touches the ground.

backs must, therefore, be safe men—cool and quick in an emergency, to be depended upon, whether they have to make their kick, or to run with the ball, or to touch it down behind their own goal-line, or to tackle an opponent.

It is usual for the captain to occupy a position outside the scrummage, although in some good clubs he does occasionally play forward. As half- or three-quarter- back he is, perhaps, in the best position to see all that goes on, and be able to appeal to the referee, should a rule be infringed; he can also see readily whether any of his team shirk their duty, or do not seem quite up to the work required of them, and can then make any necessary changes in their disposition. As a forward, his attention would be too much concentrated on the ball, and in the thick of the scrummages he must often miss many points of the play.

With this preliminary explanation of the field of play, and of the position of the players, it is now possible to give a short account of the game in some of its phases, with a view to the more ready comprehension of the numerous rules which make up the Rugby Football Code.

The teams having met on the field of play, the captains toss for choice of goals, the loser taking kick-off; or the winner may, if he prefer, elect to take kick-off, leaving choice of goals to his opponent. If the goals can be set so that the wind, if there be any, may blow across the ground, and not from goal to goal, so much the better; but this cannot always be done, and the captain must often be guided in his choice of goals by the consideration of the comparative advantages of playing with or against the wind for the first-half of the time of play. If the field of play be a little up-hill towards either goal, this will also be a consideration. No general rule can be laid down as absolute for all teams, as captains could without doubt testify: some consider it is, perhaps, best to take all the disadvantages to begin with, when the players are fresh, so that when "half-time" is called, and the team changes ends, they may lose all sense of being fagged in the knowledge of the help afforded them by the wind and ground having suddenly changed in their favour; others think it advisable to take the benefit of the wind in their favour to begin with, in the hope that it may drop before half-time.

The goals having been selected, the ball is taken to the centre of the ground, and placed in a small nick to keep it steady, preparatory to the kick-off. This must be a place-kick (which is explained in Law 2), and until the ball is kicked all the members of the opposing team must keep at least ten yards away from it in the direction of their own goal. The forwards of either side range themselves in two lines some ten yards apart, with their half-backs, three-quarter-backs, and backs at varying distances behind them. All being ready, the ball is kicked off.* Should it pitch in touch, it must be kicked off again, if the opposite side so claim; but if not, play begins in earnest. It may be that, as the ball bounds from the ground, it is seized by one of the opposing backs, who either drop-kicks

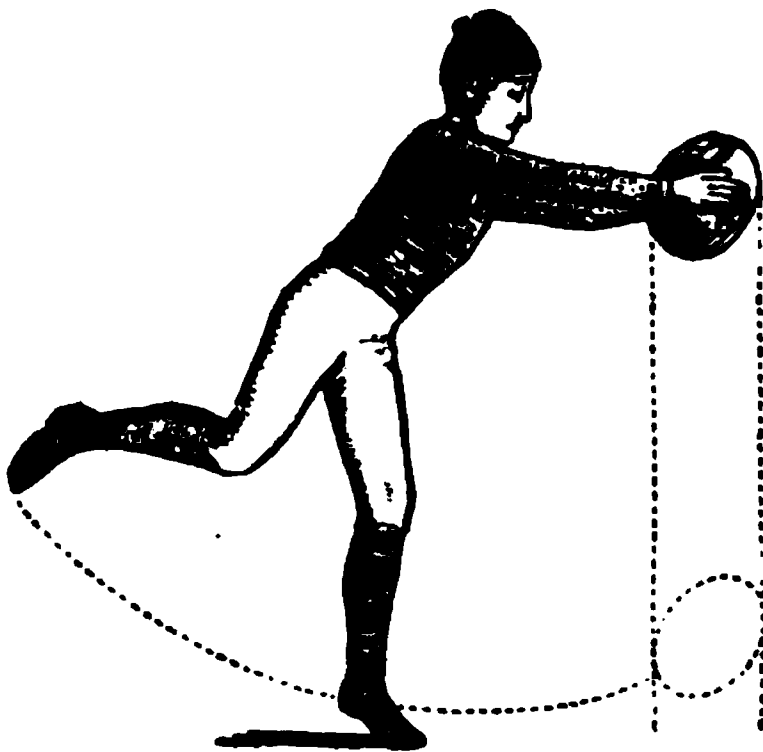


Fig. 3.—DROP-KICK.

* One word as to the best way to kick off. The ball should be kicked high in the air, to allow the forwards time to follow up, and get as close as possible to their opponents' backs before it touches the ground.

it or runs away with it, taking a drop when he sees he is about to be tackled. The next man who picks up the ball is, perhaps, caught ere he can start. When the ball is firmly held by an opponent, the one in possession of it must at once cry "Have it down!" and then the forwards of both sides hurry up, and a "scrummage" is formed. Here the nine forwards of either side face each other and their opponents' goal, packed tightly round the ball in a compact, circular mass, bodies and legs close together, every player pressing closely against his neighbour, and endeavouring by every means in his power, *except by random kicking*, to drive the ball either by main force through the mass of his opponents and towards their goal; or to "screw" his opponents—that is to say, to slide them off the ball, while his own team keeps well on it. As to the formation of a scrummage, the best players have from time to time differed considerably. The common practice now is for players to put their heads down, both that they may be able to see the ball—especially important in "screwing"—and also that they may use their shoulders with more effect.

On emerging from the scrummage it may chance that the ball is driven over the goal-line of one or other side. If the ball be touched down by one of the defending side, what is called a "touch down" occurs, and the ball is then brought out to the line between the twenty-five yards post flags, and started again with a drop-kick. Or if the ball be touched down by an enemy a "try" is obtained, and a "try at goal" follows, the procedure being as follows:—The player who touched the ball down, or another of his side appointed by the captain, brings the ball up to the goal-line in a direct straight line from the spot where it was touched down, and then he brings the ball out into the field of play such a distance as he may think convenient for a place-kick. The captain having appointed some one to try the kick at goal, the player who has brought the ball out makes a small nick for the ball to rest in; and just behind an imaginary straight line drawn through this spot parallel to the goal-line, all the other players of that side range themselves, stretching across the ground, and facing the enemy's goal. The other side must remain within their own goal until the ball has been placed on the ground, and they therefore spread themselves out along and behind the goal-line, waiting to rush out directly the ball touches the ground. All being ready, the player appointed to kick the ball gives the signal, the one who has brought it out from the goal-line places it on the ground, and the try is made. Directly the ball reaches the ground, the opposing team may rush out and charge the ball, and if any one of them should touch it, no goal can be scored, even though it pass over the cross-bar. If a goal should be obtained, the ball is kicked off afresh from the centre of the ground by the side who lost the goal. But if the try fail, the ball is 'dead', and the game proceeds by a "kick-out," that is to say, by a drop-kick from within twenty-five yards outside the kicker's goal-line.

It will continually happen that the ball is driven into touch; but the method of procedure in such a case is so clearly explained in Laws 27 to 31 of the code that further comment on this point is unnecessary. The ball should always be thrown out from touch by one of the half-backs, who should therefore be accurate throwers, and able to cast the ball a long distance. When the ball is thrown out, the forwards of each side should range up in line, every player being careful to mark an opponent, so as to prevent him from getting away with the ball. If possible, every man should have his own appointed place in lining out, which he can occupy directly the ball goes into touch.

The Laws relating to *off-side* deserve a special word of mention. (See Laws 21 to 23.) Some of the younger school-clubs show much disregard of this important matter, and beginners at the game seem to find it difficult to understand when they are *on-side* and when *off-side*. The matter is, however, very

simple, as a careful perusal of the Laws will show; and it should be the care of every Football captain to see that his men not only clearly understand the Laws, but also carry them into practice.

A great feature of the Rugby Union game at the present day consists in well-organised *rushes* by the forwards. In what is known as a rush the forwards of one side, acting closely in concert, rush the ball through their opponents, and by accurate and careful dribbling carry it right past the three-quarter-backs and the full-back, and beyond the goal-line. Backs find it very hard to meet these planned rushes: they can contend with a single dribbler, or a man running with the ball, but as a rule they have but one chance when meeting a compact mass of dribblers—at all risks they must fall on the ball, and cause a scrummage to be formed.

Dribbling is not practised half so much as it ought to be, and in this feature of the game Rugby Union players have much to learn from their Association brethren. A good dribbler should push the ball along slowly, keeping it well at his toes, so as never to overrun it, and so lose control of it.

There remain two or three points on which a few words of advice may well be given to young football-players following the Rugby Union Rules. In the first place, play unselfishly, with a discriminating regard for the best interests of your side. If you do this, you will always be ready to pass the ball back to a friend when you see you are likely to be collared, instead of hugging it to the bitter end. But if you do pass the ball back, make sure that it gets into the right hands; do not throw it wildly into the air when you are tackled, but if you see no chance of passing it with safety, cry "Have it down!" at once, and waste no time. Under no circumstances should a player pass a ball when he is in his own "twenty-five." When you are running with the ball, never lose ground in endeavouring to elude an opponent, and never run back towards your own goal unless you see a chance of making a good drop-kick; it will be far better to be tackled and have the ball down at once, or, better still, to take a drop directly you find you are losing ground. When the ball is near your own end of the ground, never run in front of your goal with it, but keep out towards the touch lines. Practise place-kicks and drop-kicks. Many a game has been lost by the stronger side from the fact that the team did not include any one who was safe at place-kicking, so that tries were seldom converted into goals. A match now is won by a majority of points. If equal, the match is drawn. It is often possible to drop a goal from the field of play, and one so secured is worth as much as one following a run-in. But even setting aside the chance of obtaining a goal in this way, drop-kicking is of the greatest value, and yet you cannot become a sure drop-kick (able to use either foot) without constant practice.

In running with the ball always carry it on the side most distant from the nearest opponent, so that the nearest arm may be available to push off a tackler. In tackling a man always collar low, that is, seize him round or below the waist: it is most difficult to hold a man securely when he is seized round the neck or shoulders. A back making a drop or punt should kick the ball high in the air, so that the forwards on his own side may have time to follow up, and get close to it when it falls. As a rule, too, he should kick into touch, as he will thus gain perhaps as much as forty or fifty yards for his side.

For all other points of the Rugby Union game not yet dwelt upon, the reader is referred to the Laws, which are now given in detail:—

LAWS OF THE RUGBY UNION.

1. A Drop Kick is made by letting the ball fall from the hands, and kicking it the very instant it rises.
2. A Place Kick is made by kicking the ball after it has been placed in a nick made in the ground, for the purpose of keeping it at rest.

3. A Punt is made by letting the ball fall from the hands, and kicking it *before* it touches the ground.

4. Each Goal shall be composed of two upright posts, exceeding eleven feet in height from the ground, and placed eighteen feet six inches apart, with a cross-bar ten feet from the ground.

5. A Goal can only be obtained by kicking the ball from the field of play direct (i.e., without touching the ground or the dress or person of any player of either side) over the cross-bar of the opponents' goal, whether it touch such cross-bar or the posts or not; but if the ball goes directly over either of the goal-posts it is not a goal. A goal may be obtained by any kind of kick except a *punt*.

6. A Try is gained when a player touches the ball down in his opponents' goal.

7. A match shall be decided by a majority of points. The following shall be the mode of scoring:—

A try	... ..	equals	3 points
A penalty goal	... ..	„	3 „
A goal from a try (in which case the try shall not count)	... ..	„	5 „
Any other goal	... ..	„	4 „

8. The ball is *dead* when it rests absolutely motionless on the ground.

9. A Touch Down is when a player, putting his hand upon the ball on the ground in goal, stops it so that it remains dead, or fairly so.

10. A Tackle is when the holder of the ball is held by one or more players of the opposite side.

11. A Scrummage takes place when the holder of the ball, being in the field of play, puts it down on the ground in front of him, and all who have closed round on their respective sides endeavour to push their opponents back, and, by kicking the ball, to drive it in the direction of the opposite goal-line. A scrummage ceases to be a scrummage when the ball is in touch or goal.

12. A player may take up the ball whenever it is rolling or bounding, except in a scrummage.

13. When once the game is started, the ball may be kicked or picked up and run with by any player who is on-side at any time; except that it may not be picked up—

(a) In a scrummage.

(b) When it has been put down after it has been fairly held.

(c) When it is on the ground after a player has been tackled.

14. In a scrummage it is not lawful to touch the ball with the hand under any circumstances whatever. If, in the opinion of the Referee, any player shall, in a scrummage, intentionally either handle the ball or fall down, he shall, on a claim from the opposite side, award a free kick, such free kick to be taken in accordance with Law 43.

15. It is lawful for any player who has the ball to run with it, and if he does so, it is called a *run*. If a player runs with the ball until he gets behind his opponents' goal-line, and there touches it down, it is called a *run in*.

16. It is lawful to *run in* anywhere across the goal-line.

17. The goal-line is in goal, and the touch-line is in touch.

18. In the event of any player holding or running with the ball being tackled, and the ball fairly held, he must at once cry *down*, and immediately put it down. If, in the opinion of the Referee, he has not immediately put the ball down, or if he, being on the ground, has not immediately got up, he shall, on a claim from the opposite side, award a free kick, such free kick to be taken in accordance with Law 43.

19. Touch in Goal (see Plan on page 31).—Immediately the ball, whether in the hands of a player or not, goes into touch in goal, it is at once dead and out of the game, and must be brought out as provided by Laws 36 and 37.

20. Every player is *on-side*, but is put *off-side* if he enters a scrummage from his opponents' side, or, being in a scrummage, gets in front of the ball, or when the ball has been kicked, touched, or is being run with by any of his own side behind him (i.e., between himself and his own goal-line). No player can be off-side in his own goal.

21. A player being *off-side* is put *on-side* when the ball has been run five yards with, or kicked by, or has touched the dress or person of, any player of the opposite side, or when one of his own side has run in front of him either with the ball or having kicked it when behind him.

22. Every player when *off-side* is out of the game, and shall not touch the ball in any case

whatever, or in any way interrupt or obstruct any player until he is again *on-side*. In case any player wilfully touches the ball when he is off-side, the opposite side may claim (i.) a free kick, such free kick to be taken in accordance with Law 44, where such off-side play occurred; or (ii.) a scrummage at the spot where the ball was last played before the offence occurred. When any player *has the ball*, none of his opponents who are off-side may run, or attempt to tackle, or otherwise interrupt such player, until he has run five yards or taken his kick. But if any player when off-side tackles or in any way interferes with an opponent who has the ball before such opponent has run five yards or taken his kick, the opposite side may claim either (i.) a free kick, such free kick to be taken in accordance with Law 43; or (ii.) a scrummage at the spot where the ball was last played before the offence occurred.

23. **Throwing Back.**—It is lawful for any player who has the ball to throw it back towards his own goal, or to pass it back to any player of his own side who is at the time behind him, in accordance with the rules of *on-side*.

24. **Knocking on** (i.e., hitting the ball with the hand) and throwing forward (i.e., throwing the ball in the direction of the opponents' goal-line) are not lawful. If the ball be either *knocked on* or *thrown forward*, the opposite side may (unless a fair catch has been made, as provided by the next Law) require to have it brought back to the spot where it was so knocked or thrown on, and there put down. Unless it be knocked on from a throw out of touch, when see Law 29.

25. A Fair Catch is a catch made direct from a kick or a throw forward, or a knock on by one of the opposite side, provided the catcher makes a mark with his heel at the spot where he has made the catch, and no other of his own side touch the ball. A player who has on a claim been awarded a fair catch must thereupon himself either take a drop-kick or punt, or place the ball for a place-kick: such kick in any case to be made in the direction of the opponents' goal-line. If the player retires behind his own goal-line for the purpose of taking such kick, the ball must be kicked across such goal-line in the direction of the opponents' goal-line. After a fair catch has been made, the opposite side may come up to the catcher's mark, and the catcher's side retiring, the ball shall be kicked from such mark, or from a spot any distance behind it, in a straight line, parallel with the touch-lines.

26. **Touch** (see Plan).—If the ball goes into *touch*, a player on the side other than that whose player last touched it in the field of play must bring it to the spot where it crossed the touch-line; or if a player, when running with the ball, cross or put any part of either foot across the touch-line, he must return with the ball to the spot where the line was so crossed; and thence return it into the field of play in one of the modes provided by the following Law.

27. He must then himself, or by one of his own side, either (1) bound the ball in the field of play, and then run with it, kick it, or throw it back to his own side; or (2) throw it out at right angles to the touch-line; or (3) walk out with it at right angles to the touch-line, any distance not less than *five* nor more than *fifteen* yards, and there put it down, first declaring how far he intends to walk out.

28. If two or more players holding the ball are pushed into *touch*, the ball shall belong in *touch* to the player who first had hold of it in the field of play, and has not released his hold of it.

29. If the ball be not thrown out straight, the opposite side may at once claim to bring it out themselves, as in Law 27, sec. 3. If on a throw-out from touch the ball shall be knocked on, the opposite side may claim either (1) a free kick, such free kick to be taken in accordance with Law 43 at the spot where the knock-on occurred, such free kick not to count a goal; or (2) a scrummage at the spot where the knock-on occurred.

30. A catch made when the ball is thrown out of touch is not a *fair catch*.

31. **Kick Off** is a place-kick from the centre of the field of play, and cannot count as a goal. The opposite side must stand at least ten yards in front of the ball until it has been kicked. If the ball pitch in touch, the opposite side may claim to have it kicked off again. The kicker's side must be behind the ball when kicked off, and in case of infringement the Referee shall, on a claim by the opposite side, order a scrummage to be formed in the centre of the ground.

32. The ball shall be kicked off—(i.) at the commencement of the game; (ii.) after a goal has been obtained; (iii.) after change of goals at half-time.

33. Each side shall play from either goal for an equal time.

34. The captains of the respective sides shall toss up before the commencement of the match; the winner of the toss shall have the option of choice of goals, or the kick-off.

35. Whenever a goal shall have been obtained, the side which has lost the goal shall then kick off. When goals have been changed at half-time, the side which did not kick off at the commencement of the game shall then kick off.

36. **Kick Out** is a drop-kick by one of the players of the side which has had to touch the ball down in their own goal, or into whose touch in goal the ball has gone (Law 19), and is the mode of bringing the ball again into play, and cannot count as a goal (see Law 39).

37. Kick-out must be a *drop-kick*, and from not more than twenty-five yards outside the kicker's goal-line; if the ball when kicked out pitch in touch, the opposite side may claim to have it kicked out again. If the kick be not a drop-kick, or if the kick be from more than twenty-five yards outside the kicker's goal-line, or if the kicker's side be not behind the ball when kicked out, the Referee shall, on a claim by the opposite side, either order another kick-out or order the ball to be scrummaged at a spot twenty-five yards from the kicker's goal-line and equidistant from both touch-lines; and the opposite side may not obstruct such kicker within twenty-five yards of his own goal-line.

38. A side having touched the ball down in their opponents' goal, shall *try at goal* by a *place-kick* in the following manner:—One of the players shall bring it up to the goal-line in a straight line (parallel to the touch-lines) from the spot where it was touched down, and thence walk out with it, in a line parallel to the touch-lines, such distance as he thinks proper, and there place it for another of his side to kick.

39. The defending side may charge as soon as the ball touches the ground, but if any of them do charge before the ball touches the ground, the Referee may, provided the kicker has not taken his kick, and then only on a claim by the kicker's side, disallow the charge, and the kicker's side must remain behind the ball until the try has been decided. If a goal be kicked the game shall proceed as provided in Law 35; but if a goal be not kicked, or if the bringer out allow any of his side to touch the ball before it has been kicked, the ball shall be dead forthwith, and the game shall proceed by a kick-out, as provided in Law 37.

40. Charging (i.e., rushing forward to kick the ball or tackle a player) is lawful for the opposite side in all cases of a *place-kick* after a *fair catch* or upon a *try at goal*, immediately the ball touches or is placed on the ground; and in case of a *drop-kick* or *punt* after a *fair catch*, as soon as the player having the ball commences to run or offers to kick, or the ball has touched the ground; but he may always draw back, and unless he has dropped the ball, or actually touched it with his foot, they must again retire to his mark (see Law 42). But if any of the opposite side do charge before the player having the ball commences to run, or offers to kick, or the ball has touched the ground, the Referee may, provided the kicker has not taken his kick, and then only on a claim by the opposite side, disallow the charge. Except in a scrummage it is not lawful for a player to charge against or obstruct any opponent, unless such opponent is holding the ball, or such player is himself running at the ball.

41. In the event of a player illegally tackling, charging, or obstructing any opponent, the Referee shall, on a claim from the opposite side, award a free kick at the spot where the offence took place, such free kick to be taken in accordance with Law 43. But if, in the opinion of the Referee on a claim from the opposite side, a try would undoubtedly have been gained but for unfair play or interference of the defending side, he shall adjudge such try. On the other hand, if, in his opinion, a try would undoubtedly not have been gained but for unfair play or interference of the attacking side, he shall, on a claim by the opposite side, adjudge a touch-down. The kick in the case of a try shall be taken at any point on the line passing through the spot where the ball was, when such unfair play or interference took place, parallel with the touch-line.

42. In case of a *fair catch*, the opposite side may come up to and charge from anywhere on or behind a line drawn through the mark made, and parallel to the goal-line. In all cases the kicker's side must be behind the ball when it is kicked, but may not charge until it has been kicked. In case of any infringement the Referee shall, on a claim by the opposite side, order a scrummage to be formed at the spot where the fair catch was made. If, after a fair catch, more than one player of the attacking side touch the ball before it is again kicked, the opposite side may charge forthwith.

43. A free kick awarded by way of penalty shall be taken by either a drop, punt, or place-kick, and by any member of the side to which it has been awarded. In all other respects the kick shall be taken in the manner prescribed for fair catches in Law 25, it being understood that the place whence the kicker is entitled to take his kick shall be regarded as the mark of a player who has made a fair catch.

44. If, in the opinion of the Referee, a player shall have been guilty of rough or foul play, he shall, in his discretion, either caution him for the first offence or warn him off without any caution, but always on a second offence it shall be his duty to warn off the offender, and in every case to forthwith report the occurrence to the Rugby Union Committee, who shall, in their discretion, suspend the offender, and any club which plays with or against him during suspension, for such period as they think fit.

45. If a player shall kick, pass, or carry the ball back across his goal-line and it there be made dead, the opposite side may claim that the ball shall be brought back and a scrummage formed at the spot whence it was kicked, passed, or carried back. Under any other circumstances a player may touch the ball down in his own goal.

46. No Hacking or Hacking Over, or Tripping Up, shall be allowed under any circum-

stances. No one wearing projecting nails, iron plates, or gutta-percha on any part of his boots or shoes shall be allowed to play in a match.

47. In the case of any Law being broken, or any irregularity of play occurring on the part of either side not otherwise provided for, the opposite side may claim that the ball be taken back to the place where the breach of law or irregularity of play occurred, and a scrum formed there.

48. In all matches a Referee and two touch-judges shall be appointed; the former official must be chosen with the consent of either the respective secretaries or captains of the contending clubs or bodies. If the captain of either side challenge the construction placed upon any Law he shall have the right of appeal to the Rugby Union Committee. Subject to this right of appeal it shall be the duty of the Referee to report immediately to the Rugby Union Committee any player who disputes any of his decisions; and the Rugby Union Committee shall, in their discretion, suspend the offender, and any club which plays with or against him during suspension, for such period as they shall think fit.

49. Neither Half-time nor No-side shall be called until the ball is fairly held or goes out of play, and in the case of a try or fair catch, the kick at goal *only* shall be allowed.

A close time is fixed for playing Rugby Football, and no member of any club in England in membership with the Rugby Union is allowed to take part in any match or contest at which gate-money is taken, between April 20th and the third Saturday in September (both dates inclusive) of any year, unless the permission of the Committee of the County in which the match or contest is proposed to be played, or of the Committee of the Rugby Union, has been previously obtained. Any player transgressing this rule shall be deemed a professional, and may be suspended under Rule 4 of the Rules relating to Professionalism.

Any club willing to conform to the Rules of the Union may be admitted to membership on being properly proposed and seconded by two clubs belonging to the Union. There is an entrance fee of half a guinea, and an annual subscription of one guinea.

Having dwelt as fully as possible with Football, as played under the Rules of the Rugby Football Union, we will now proceed to describe

THE ASSOCIATION GAME.

This game is much simpler than the Rugby Union, as might be guessed from the fact that its code of laws numbers sixteen only, in place of the fifty appertaining to its rival. Its essential features are that no handling or running with the ball is allowed, that goals are the only advantages scored, and that the ball must be kicked under the cross-bar in order to secure a goal, and not over.

The ground from goal to goal (Fig. 4) should never be less than 100 yards in length, nor more than 200 yards; its width should vary in proportion to its length, from a minimum of 50 yards to a maximum of 100 yards. The lines must be marked on the turf and with flags, as already described for the Rugby Union game.

Each goal is composed of two posts, placed twenty-four feet apart, with a bar across them eight feet from the ground. The ball is not egg-shaped, as in the Rugby Union game, but round (Fig. 5), and its size is prescribed by the Laws (see Law 1). Eleven players constitute a team, and as to the best method of placing these in the field, perhaps we cannot do better than quote the authoritative opinion of Mr. C. W. Alcock, the secretary of the Football Association, who, after suggesting that the captain should be a "back" rather than a "forward"—for much the same reasons as those given in recommending a like course for the Rugby game—goes on to say:—"One player must be stationed in the very centre of the goal, in order to save it in case the outer lines have been passed by the enemy, the extreme width of the space rendering such a course, in most instances, absolutely necessary. The man selected to occupy this post should be an adept at catching—cool, and not prone to be flurried; and, should the task prove a thankless one, and free from all chances of attack, it would be advisable at times to relieve the sentinel by the substitution of another player. As a general rule, a good field at Cricket will have certainly the materials for a good goal-keeper, though considerable practice will be needed before a novice, even with this

advantage, will be properly qualified. There should be at least three other backs (in many cases it is best to have two backs, two half-backs, and a goal-keeper), two to be stationed as half-backs just outside the 'bully,' and following up as the forwards advance, the other a full 'back,' to act as the last line of defence in

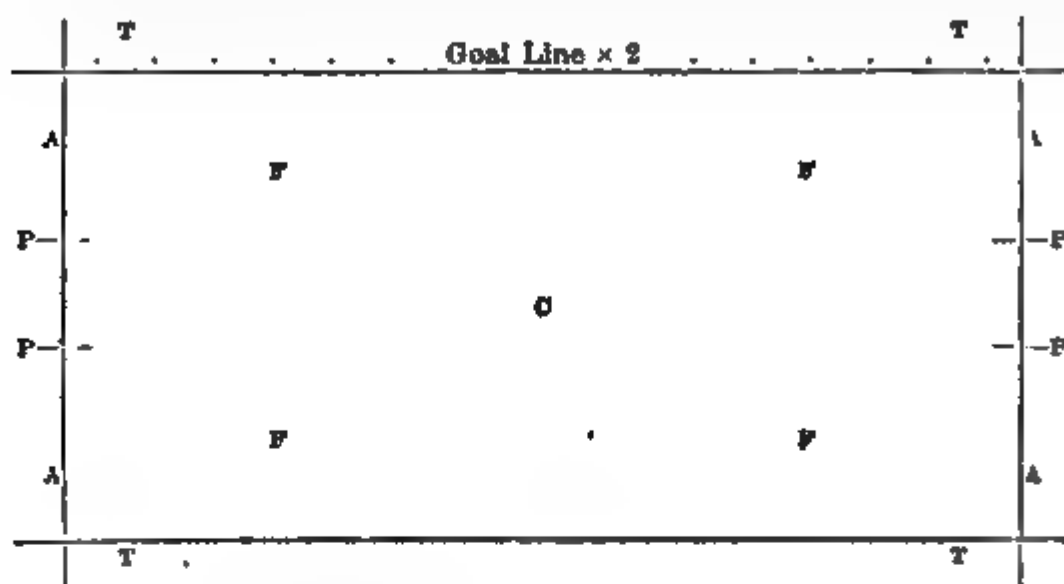


Fig. 4.—PLAN OF THE FIELD FOR THE ASSOCIATION GAME.

AA. Goal Lines.
PP. Goal Posts.
F. Field of Play.

C. Centre of Play.
TT. Lines of Touch.

front of the goal-keeper. Half-backs—Eton and Winchester produce, from the very peculiarities of their games, the finest half-backs—should be quick, active, and sure kicks in any position, while 'full-backs' should be strong, resolute, and able to kick with force as well as accuracy. In some special cases half-backs should have the option of dribbling or kicking at their discretion, but full-backs ought never to stand on the order of kicking, but kick at once.

Some clubs have two players to represent the wings of the army, flanking each side, while others depute only one to each side. The former plan is, in my opinion, the more preferable, as it is the more general, as often the wings receive the whole brunt of the attack, and four 'forwards,' backed up by this solid body, are amply sufficient as the light brigade, or advance guard of the besieging party. Wing players should be good dribblers, and should be kept as much as possible on one particular side of the ground, as with practice they get insensibly into the way of trusting more to the left foot if they follow the ball on the left side, to the right if used to the right side of the ground, and in case they are told off to the opposite side to which they have usually been accustomed, are for a time all abroad. Of course many of these hints may be altered as circumstances demand an offensive or defensive kind of play, but such wrinkles experience alone will teach. When contending against a weak opponent, or with a very strong wind, one of the half-backs may be pushed to the front, but under no circumstances whatever should the goal-keeper be allowed to leave the immediate neighbourhood of his post. The disadvantage of a strong wind will be considerably lessened by strengthening the numbers placed on the windward side. Association Football, however, is of such a Protean nature, that it is difficult to offer a prescription for all the different phases of the game, which can be gained only by the crucial test

Fig. 5.—THE ASSOCIATION BALL.

of experience. The best teaching is the unwritten law of constant, careful practice."

An important feature of the Association game consists in "dribbling" the ball, namely, in working the ball along with the feet, pushing it on with a series of gentle kicks, and guiding and piloting it past opponents towards the desired goal.

The success of his side should be the foremost consideration with every player, and with this end in view he must always be ready to give up chances of distinction, should occasion require, and must even be prepared to see praises showered on another member of his team for a brilliant piece of play rendered possible by his self-sacrifice. It is very essential, too, that all the members of a team should work well together, and especially that the forwards should "back up" well, namely, that they should follow close on the ball, and always be prepared to take it from a fellow-player, or to assist him by any means in their power. Except under very special circumstances, and when the play is dangerously near his own goal, the player should endeavour to keep the ball in the centre of the ground, and should not drive it out to the touch-line. Let him have clearly in view that, as a rule, it will be more advantageous to pass the ball on to a friend who can continue its straight course towards the enemy's goal, than to be gradually forced by his opponents to dribble it out towards the side of the ground, and lose his point of vantage.

LAWS OF THE FOOTBALL ASSOCIATION.

1. The limits of the ground shall be : maximum length, 200 yards ; minimum length, 100 yards ; maximum breadth, 100 yards ; minimum breadth, 50 yards. The length and breadth shall be marked off with flags and touch-line ; and the goals shall be upright posts, 8 yards apart, with a bar across them, 8 feet from the ground. The average circumference of the Association ball shall be not less than 27 inches, and not more than 28 inches, and in International matches at the commencement of the game the weight of the ball shall be from 13 to 15 ounces.

2. The winners of the toss shall have the option of kick-off or choice of goals. The game shall be commenced by a place-kick from the centre of the ground, in the direction of the opposite goal-line. The other side shall not approach within ten yards of the ball until it is kicked off, nor shall any player on either side pass the centre of the ground in the direction of his opponents' goal until the ball is kicked off.

3. Ends shall only be changed at half-time. After a goal is won, the losing side shall kick off, but after the change of ends at half-time the ball shall be kicked off by the opposite side from that which originally did so ; and always as provided in Law 2.

4. A goal shall be won when the ball has passed between the goal-posts under the bar, not being thrown, knocked on, or carried by any one of the attacking side. The ball hitting the goal, or boundary posts, or goal-bar, and rebounding into play, is considered in play. The ball crossing the goal or touch-line, either on the ground or in the air, is out of play.

5. When the ball is in touch, a player of the opposite side to that which kicked it out shall throw it in from the point on the boundary-line where it left the ground. The thrower, facing the field of play, shall throw the ball over his head with both hands in any direction, and it shall be in play when thrown in. The thrower shall not play until the ball has been played by another player.

6. When a player kicks the ball, or throws it in from touch, any one of the same side who, at such moment of kicking or throwing, is nearer to the opponents' goal-line, is out of play, and may not touch the ball himself, nor in any way whatever prevent any other player from doing so until the ball has been played, unless there are, at such moment of kicking or throwing, at least three of his opponents nearer their own goal-line ; but no player is out of play, in the case of a corner-kick, or when the ball is kicked off from goal, or when it has been last played by an opponent.

7. When the ball is played behind the goal-line by one of the opposite side, it shall be kicked off by any one of the players behind whose goal-line it went, within six yards of the nearest goal-post ; but if played behind by any one of the side whose goal-line it is, a player of the opposite side shall kick it from within one yard of the nearest corner flag-post. In either case no opponent shall be allowed within six yards of the ball until it is kicked off.

than either racquets or tennis; and it is indeed perhaps the most severe of any when played with real energy and determination. The best players generally play without gloves; and after a little practice their hands become hard enough to deal a much more forcible blow than they could if they were protected with pads. One of the principal advantages which fives can boast over the other games is that it exercises both hands and both sides of the body equally, since a good player must of course be prepared to return a ball as well with the left hand as with the right. No one can exaggerate the importance of this benefit; and it is to be hoped that in spite of the competition of other games, fives will long retain and even improve upon its position as a favourite exercise for boys.

RAQUETS.

A RACQUET-COURT (Fig. 1) resembles a fives-court, just as the game of racquets resembles fives; but it is very much bigger, and can be erected only at a large cost. Hence, it is for the most part only in the large public schools and at the Universities,

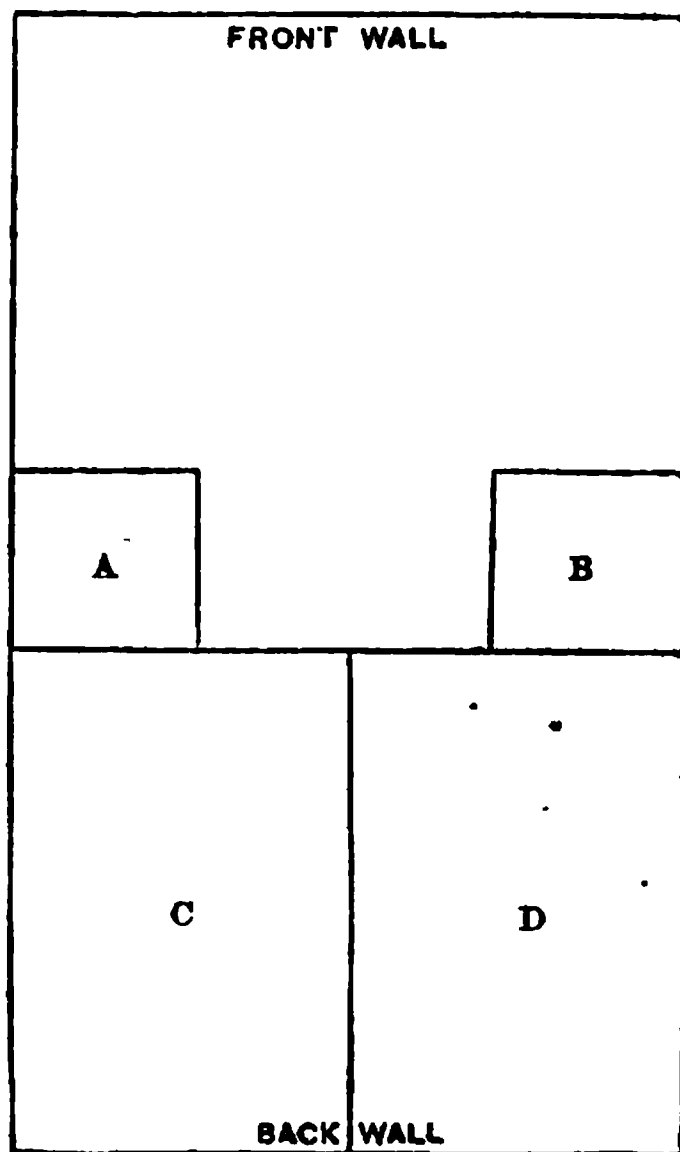


Fig. 1. —RACQUET-COURT.

and a few great towns, where one can be found to play in. These courts are of various sizes, ranging from fifty to fully eighty feet in length, and from thirty to forty feet wide, with a very high roof and a back wall of less height, having at the top of it a gallery for spectators, who can thus look into the court from above. Across the front wall, which is black, is fixed a board; or baulk, about two feet two inches high, and a white line, called the "cut" line, is also traced across it, about seven feet nine inches or eight feet above the floor.

The floor itself, which should be of smooth stone, asphalt, or concrete, perfectly level, is divided into sections, as shown in the diagram (Fig. 1). About half-way down the court, but nearer to the back wall than the front, a line is marked parallel to those walls; and the back part so marked off is divided into two equal portions, C and D, by a line traced at right angles to the back wall. The two small spaces marked A and B are service-spaces, within which the person who serves must place one or both of his feet. The balls are not more than half the size of fives balls, and are played with "racquets,"

a peculiar kind of bat, like a battledore, with strong catgut laced cross-wise through the frame (Fig. 2).

The game is begun by one of the players striking the ball against the front wall, above the white line, so as to fall, without bounding, into the back court opposite. Thus, if he stands at A, he must strike the ball into D, where it must be taken by one of the players on the other side, either at the volley or at first bound. If, in serving, the ball is struck against the side

wall, or roof, or floor, before it hits the front wall, or if it is served below the baulk line, or is struck so hard as to go out of court, it is a "hand out"—that is to say, the striker loses his innings. If the ball is served from the wrong place, or if it hits the front wall above the baulk line, but below the white one, or if, after properly hitting the front wall, it fall into any but the right court, or hit the roof or gallery without going out of court, it is called a "fault," and the person to whom it is served is not obliged to take it. He may do so, however; and if he does, the game proceeds as if it had been properly served. Should he attempt to take it, and fail, the server then scores an ace; and the same result follows whenever his opponent or opponents fail to return the ball above the lower line. When an ace is won, the man in goes over from A to B, and then "serves left"—that is to say, into court C. The out-players stand behind the server while the ball is being served and taken; and afterwards the usual arrangement is that the server shall take all the balls which fall inside the cross line, and his partner shall take all which fall farther back. The man who is served to, on the other side, takes all which fall in the back courts, while his partner attends to those which fall nearer the front wall. The game is made

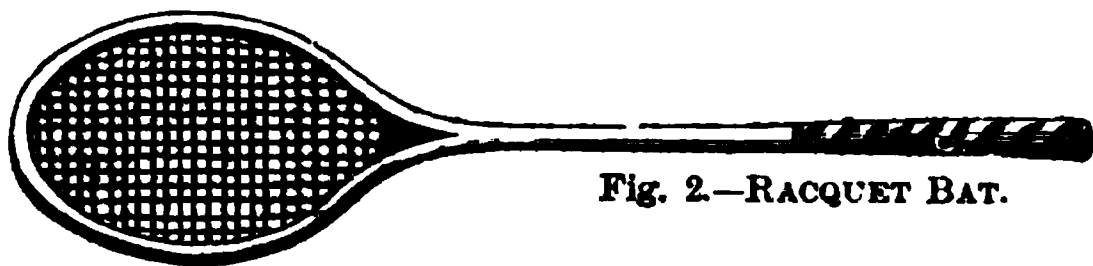


Fig. 2.—RACQUET BAT.

up of fifteen aces, and after the first player is put out, the others succeed one another in order, each pair of partners having to be put out before the other side goes in. Thus, supposing that M and N are playing against X and Y, and that M and X are both better players than their respective partners. The question which side shall go in first is usually decided, not by tossing a coin as in cricket, but in the following way. It will be discovered, on looking closely at a racquet, that at the thin end of it, nearest the handle, the strings which cross the frame from edge to edge are twisted round the others which go lengthwise, so as to project on one side or face of the racquet, and give it a "rough" appearance, whereas on the other side they do not project, but are "smooth." When, therefore, it is required to decide as to innings, one of the players holds his racquet downwards with the handle between his finger and thumb, so that the top part of it rests on the floor of the court. He then gives it a spin, and lets it fall, while one of the adversaries in the meantime calls "rough" or "smooth." When the racquet has fallen on its face, it is examined to see which side is uppermost, and the question of innings is decided accordingly. Supposing, then, that M and N have called "rough," and that "rough it is," M, being the better player of the two, will proceed to serve, and as he and his partner score each ace, the game will be called "one love," "two love," "three love," &c. If he is put out after making three aces, X will succeed him, and as he serves the game will be called "love three." As he makes his score it will be called "one three," "two three," "three all," and so on, until he also is put out, when his partner must go in, and serve from the court opposite to that from which the last service was made. When he is out M will go in, and be followed by N. When a game has been won there is no change of innings, but the player who was serving when the game ended begins the next game at "love all," and when he is out his two adversaries go in in what order they please. Thus it will be seen that at the commencement only one hand is allowed to go in, but afterwards the two hands on each side go in successively till the game is won. It will also be remarked that a player who is good at serving has a great advantage, as whenever he scores the game, which he is sure often to do, he secures not only this benefit, but that of first innings in the next game. It is generally the rule, that when the game is called "thirteen

all," it may, upon the demand of the out-player, be "set at five"—that is to say, a sort of complementary second game is started, in which five aces must be won before the game can be counted to either side. In a similar way at "fourteen all," the game may be "set" at three.

The rules as to touching a ball with the body or racquet are rather difficult. If, in serving, the ball touches either the server or his partner before it has made a second bound, it puts him out. If any striker, in returning the ball, hits it against the racquet, or any part of the body, of his partner, it counts an ace, or a hand-out, as the case may be, against him. If, however, it hit an adversary, it is for the umpire to decide whether it would have gone up or not. If not, it scores an ace against the striker, but in the other case it is a "let," and the ace must be played over again. It is a "let," also, if an out-player get involuntarily in the way of the striker, or baulk him in getting to the ball; but if he do either of these things purposely, or touch the ball out of his turn, whether willingly or not, it counts an ace against him. It is a "hand-out" when the server makes two consecutive "faults" in his service.

These are the principal rules; and to achieve success in what is really one of the most difficult of games, a good eye, a strong wrist, and, above all, a quick nerve and great activity are required. The young player should not be too ambitious of making sharp returns just above the line, but be content at first if he can return the ball at all. When he is able to make pretty sure of this it will be plenty of time to practise "drops," in which the ball is sent gently back into one corner, or those long low slashing hits just above the board, which are made by the most brilliant and successful players. It will be easily perceived that for this game a great practical knowledge of angles is required, especially as regards the back corners of the court, where the play is most difficult. It is essential also to have an acquaintance with the twist of a "cut" or "boasted" ball in accordance with the principles partly explained in the remarks on tennis (p. 49).

A few hints for general use in a racquet-court will be of assistance to young players.

1. Never take a ball which does not "belong to you"—that is to say, which does not fall in the court which for the time being it is your place to defend. If you do so you will not only over-fatigue yourself, but, what is much more important, will annoy and disgust your partner, who would have a fair right, if he chose, to retaliate.

2. The only exception to this rule is when your partner, seeing that *he* cannot get the ball, and *you* can, shouts out "take it," or implies the same by getting out of the way.

3. Never take a ball at the volley when there is any reasonable chance of taking it at the first bound. Never by any means do so simply to save trouble. A volley stroke is always risky, especially for young players, and has a tendency to "unsettle" one's play.

4. Never hurry to take a ball before the time when you have the best chance of making a good stroke. You may wait till it is within a very few inches of the ground, and yet make quite as good a stroke as if you hit when it was a foot or a yard high. Many inexperienced players strike wildly at a ball as it goes rapidly to the back wall, and miss it, and then have the mortification of seeing it come off from the wall behind them in the easiest and most inviting style.

5. Do not be continually trying to do fancy strokes, and win the ace at one *coup*, but play a safe game, and let your partner think that he can depend upon you.

6. Do not stand too far "up" in the court; it is easier to run forward than backwards; but you must be ready to start forward at the first sign of a "drop" stroke.

7. When playing "up" do not turn round and face the strikers behind you: you may be cut over by a ball in the eye or face. It is better to crouch down and cover the head with your racquet as a shield than either to receive a nasty blow or to spoil a good stroke of your partner's by blocking up the way.

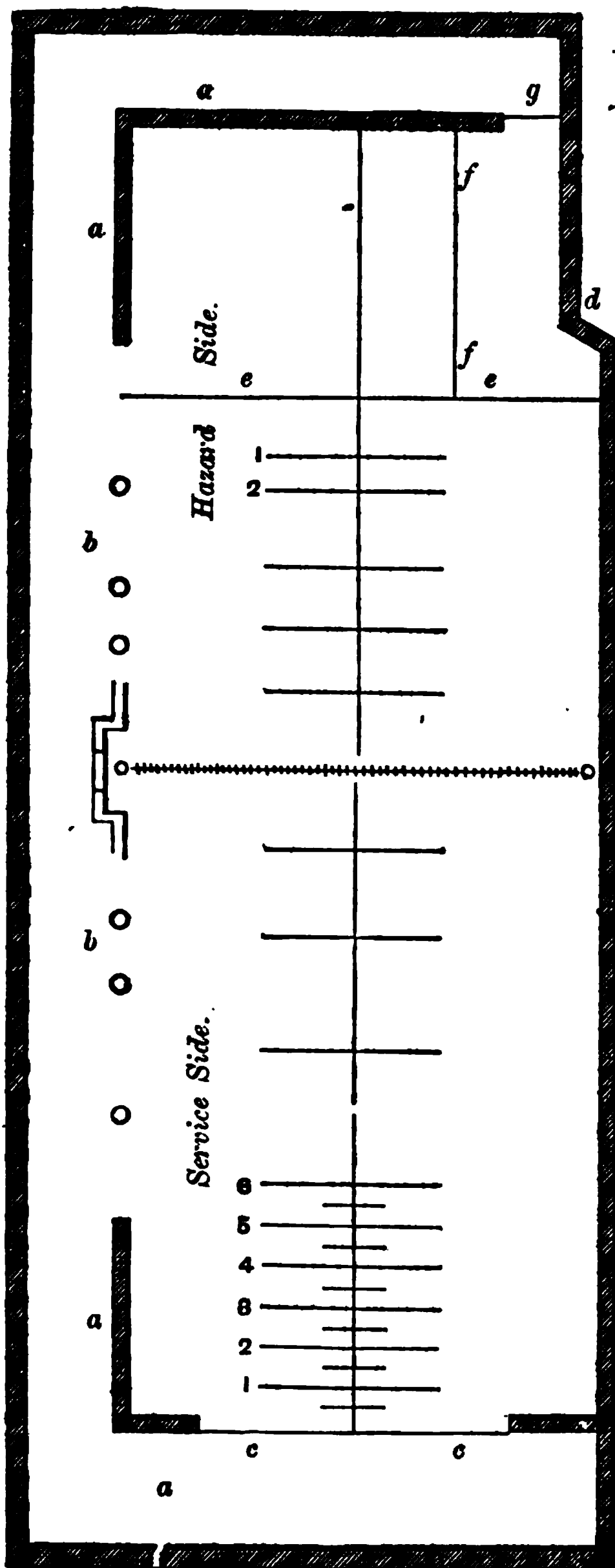
8. When playing "back," if you cannot judge whether a ball will hit the back wall or the ground first, allow rather for the former event. If you are wrong, you will still very likely have time to get back; whereas, in the other case, if you have miscalculated, the ball will easily outstrip you beyond hope of recovery.

TENNIS.

THE game of Tennis—most famous and most difficult of all games of ball—was for a long time the most fashionable pastime for all persons of royal and noble birth. Various circumstances, and amongst them more especially the great cost of erecting a court, and the length of time required for learning to play even tolerably, have tended to make it less and less common, until now the number of courts in the country may perhaps almost be counted on the fingers. Theoretically, however, the game remains as the perfection and pattern of its species, comparable to no other except billiards, and worthy at any time to resume the place it once occupied.

A tennis court (Fig.) is from ninety to ninety-six feet long, more than thirty feet high, and about thirty-eight and a half feet wide. Three of its sides are formed into a species of corridor—as shown in the diagram (a)—by means of an inner wall, seven feet two inches high, from the top of which rises a sort of roof, sloping upwards to the outer wall, which it joins at the height of ten feet seven inches. This sloping roof is called the "pent-house," and is perhaps the most characteristic feature of a tennis court. The wall which supports it is cut away in parts at a height of three feet eight inches from the floor, leaving an open space all along the middle of the court, called the galleries (b b), and having in this part six posts running up to the outer ridge of the pent-house. There is another large opening (c) of a similar sort, twenty-one feet long, at the top or service side of the court, called the *dedans*; and it is through this opening that the spectators usually look on at the game. Opposite to the *dedans*, and in the far corner of the other side, is a much smaller opening called the *grille* (g), which is about three feet square. As often as the ball is struck into either the grille on one side or the *dedans* on the other, it counts a point for the striker. The fourth wall is flat and smooth from floor to ceiling, except that at a spot about twenty feet from the grille there is an angle in it jutting out, as shown at d, which is called the *tambour*. Finally, a net is hung exactly midway between the two ends, reaching right across the court, and stretched tight, so that it is five feet from the ground at each side, and four feet in the middle.

The floor of the court is thus arranged:—A line is drawn lengthways down the whole length of it, and across this on the "hazard side" of the court, which is opposite to the *dedans*, about twenty feet from the inner wall, is traced the "service line" (e e), and at right angles to this again is the "pass line" (f f). Besides these, a great number of other cross lines are traced as shown in the diagram, six of them on the service and two on the hazard side being called "chaces," and the rest "galleries." The game is commenced by the player standing in the service side, who hits the ball on to the pent-house, and from thence into the far part of the hazard side, beyond the service line, but not over the pass-line. If he makes two "faults," he loses a point. When the game has begun, it becomes the object of each player to strike the ball over the net, and he



TENNIS COURT.

who first fails to do so loses a point. A stroke into the *grille* or the *dedans* counts a point for the striker, while a ball which hits the ceiling, or any of the walls above a line thirty feet high, scores a point against the striker. The use of the chaces and galleries is too intricate to be explained except by a practical lesson. It may suffice to say, that when a ball falls after its first bound into one of them the stroke remains in abeyance, and has to be played out afterwards by the players changing sides, and the out player endeavouring to make a better stroke than that which was reckoned as a chace. The game is of four points, which are scored thus:—15, 30, 40, and game; but when each party is at 40, the scorer calls "deuce;" and then two "vantages," or "advantage strokes," must be won successively in order to secure the game. Sets of eleven games, that is to say, the best out of eleven, are usually played: and when the players are five games all, it is sometimes the rule to play similarly for two advantage games, which must of course be won successively.

These being the main features of the game, it remains to say that after the rules of play have been mastered, a whole host of difficulties arise before the young player can be said to have made any real progress. These are caused not only by the multiplicity and complication of the angles by which the course of the ball is affected, more especially in the case of the pent-house and tambour strokes, but also by the very different degrees of force with which the ball is returned, and the twist or "screw" which a good player

is able to give to it. To explain this, it will be necessary to say a few words about "cut" balls. A cut ball is one which is hit with the racquet held obliquely, so that, although by the force of the blow and the direction of the racquet-handle it is sent straight forward towards the net, yet, by the sidelong action of the racquet-strings, a revolving motion is given to it, causing it to spin round on its own axis, and so leading to some very remarkable changes in its subsequent course. The first of these is that the ball as it flies keeps edging sideways in an opposite direction to the side on which it was struck. Thus, if it was cut from below, it will describe an upward curve; if it is hit on the right side by what is called an over-hand cut, it will bend towards the left, while a left-hand or under-hand cut will give it a bias towards the right. This is the first effect of the cut: but more perplexing results remain to be noted. For the effect of the spinning movement communicated to the ball is that as soon as it strikes any object, whether the floor or any of the walls, it glances sideways from it in the direction of the spin. However many walls it may hit, it will still retain more or less of the original bias, for which the player, in attempting to return it, must allow. Both billiard players and cricket players will soon understand this principle, which is not different from that of the twisting balls of a good bowler, or from the spin with which a leg-hit breaks away. But the large size of the tennis ball, and the great command over it exercised by the racquet, make the whole doctrine of cut and twist more important in a tennis court than anywhere else, except on a billiard table. There is another way in which a spin is given to the ball, and that is by the effect of a stroke along the side wall, which is such as to make the ball twist back towards the same wall again. It is not necessary, for the acquisition of this twist, for the ball to be struck sideways by the racquet. The spin is imparted by the action of the wall itself, which, however smooth it may be, catches the side of the ball with which it comes in contact, and gives it a rotatory movement quite as pronounced as that of a "cut" ball. Such balls are called "boasted" balls—a term which, like many others used in this game, is a corruption from the French.

There are several other terms which it would not be worth while to explain, as they will be learnt more easily during the first practical lessons in court. Thus, the "batteries" are those parts of the wall which are below the *dedans* and the galleries, and which, as has before been mentioned, are only three feet eight inches high. All the several other walls, moreover, have their different names, as well as all the several compartments into which each side of the court is divided. There is an umpire in every match game; and his utmost exertions are needed, as may be supposed, to determine any question as to where the ball fell. He may however, if he likes, appeal to the spectators in the *dedans*, who, when consulted, decide the point by a majority of voices. It is by standing in this *dedans*, and watching the game, that the young player will probably learn most, just as a young barrister is often instructed by attending the law courts, and observing what is said by more experienced speakers. Indeed, it will not be out of place to observe here that in all games of skill which demand a practical knowledge of angles and recoils, a vast deal of benefit may be derived from watching the movements of good players. The markers in racquet courts and tennis courts are always excellent performers, not so much perhaps from the practice they have, though this is an assistance, as from the experience they derive from constantly watching and closely criticising the action of all sorts of players. As soon, therefore, as the beginner has mastered the rules of the game, and played a few sets, he will do well to go through a good course of observation in the *dedans*, or, if it is a matter of racquets, in the gallery, after which he will be surprised at the rapid progress he can make, and the improvement in his style of play which is imperceptibly effected.

GOLF.

THOUGH this is the national game of Scotland, it is now largely played in England, Ireland, and other parts of the world. It is an enjoyable and healthy amusement, involving as it does a great amount of muscular exercise and plenty of walking, without at the same time calling for those spasmodic outbursts of violent energy which render several outdoor games simply "forbidden fruit" to hundreds of boys and young men. It is played over "links" (*English*, "downs" or "commons"); and the "course" will be none the less pleasing to keen golfers should it contain a fair sprinkling of sandpits, broomy knolls, and other "bunkers" or "hazards" (as they are styled), which it is the chief aim and prime duty of the player to avoid if he possibly can do so. Throughout the common there is a series of circular holes, four inches in diameter, situated at various distances, ranging from 80 to 500 yards from each other, which are generally cut on a patch of smooth turf, to facilitate "putting"—the gentle tapping of the ball as it gets near the hole. The

players are either two in number, the commoner and simpler arrangement, or four (two against two, constituting what is known as a "foursome"), in which latter case the two partners strike the ball on their side alternately. The object of the game is to drive the ball from hole to hole round the course in the fewest number of strokes, the player (or pair of players) succeeding in "holing" the ball in the fewest number winning that hole. The greatest number of holes thus gained in one or more rounds ordinarily decides the match, though sometimes it is agreed to award victory to the smallest aggregate number of strokes taken to hole the course. Each player must be furnished with a set of clubs of different lengths and shapes, to be employed according to the position of the ball or distance to be driven; for the ball, having been struck from the "tee" (a snuff of sand, or tuft of grass, to give the requisite elevation for a full drive to start with), must afterwards be struck as it happens to lie,

Fig. 1.—DRIVING.

and must not be touched by anything except a club until it reaches the hole—saving in the cases provided for in the rules. Having "teed" his ball, and called out "Fore" (see rules), the player, with his "play-club," or "driver," will drive the ball as far as he can towards the first hole (Fig. 1). He will probably have to use his "driver" again (especially if the holes are 400 or 500 yards apart), and have another swipe at the ball. If it should now, unluckily for him, fall amongst whin-bushes, or into a sand-pit, he must use his iron-headed "cleek" club for the former "hazard," or his "sand-iron" for the latter; instead of the "driver," which is useless for balls so situated. And if he succeed in hitting the ball well holewards, out of the bushes or sand, in one stroke, he may consider himself very fortunate. It is "hazards" such as these

that test a player's skill, and necessitate the use of a variety of clubs, which either the player himself, or a "caddie" (as the man or boy attendant is called), must carry round the course. Suppose that the ball has at last been driven fairly near the hole, the player will require to use the "putter" club, for his sole aim now must be to hole the ball at a stroke if he can. Concentrating all his attention upon the stroke, well measuring the distance his ball lies from the hole, and closely scanning the ground between, so as to make due allowance for inequalities, and the like, he delivers a steady even blow, and—"great stroke!"—the hole is won. The next hole is then to be fought for in much the same way, until the course is travelled over. The character of the "hazards" will doubtless vary, but the general instructions for play remain the same.

The golfer's tools (Fig. 2) are numerous and varied, consisting of the *play-club*, the *grassed-driver*, the long, middle, short, and baffing *spoons*, the heavy and light *irons*, the *cleek*, the *niblick*, and the driving and green *putters*. This is a formidable list; yet the beginner need not be disheartened. Armed with a *play-club*, a *cleek*, and a *putter*, he may acquire such proficiency as will afford him many a good day's sport; and as he advances in skill he may complete his set. The three implements named may be had for thirteen or fourteen shillings.

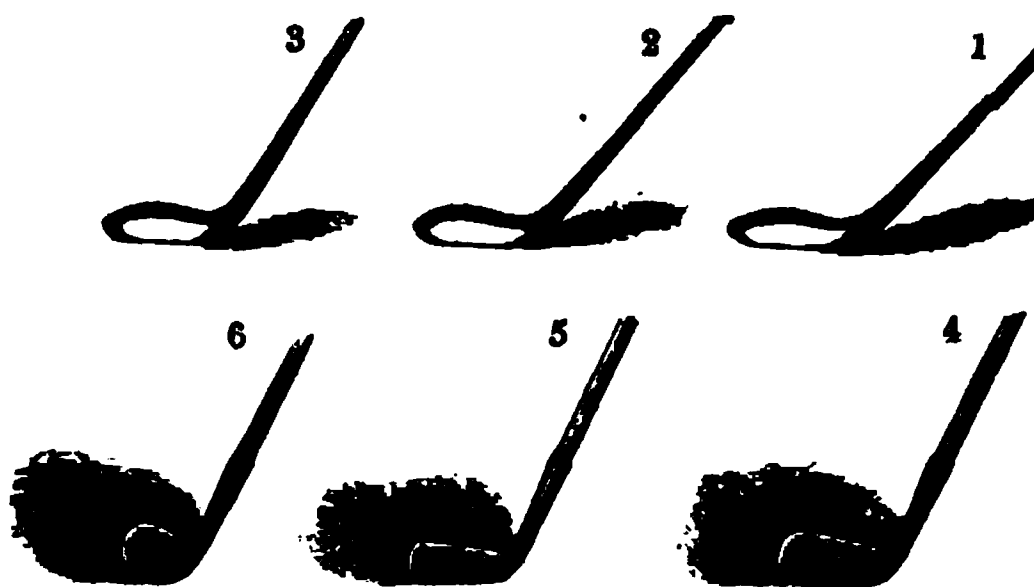


Fig. 2.—THE CLUBS.

1. Driver; 2. Putter; 3. Spoon; 4. Sand-iron; 5. Cleek. 6. Niblick.

The *play-club*, varying in length from forty-four inches downwards, should be selected inclining rather to stiffness than to springiness in the shaft, with a medium-weighted flattish head, neither too deep in the face nor too broad in the back. Its primary purpose is to drive long raking shots from the tee; but it is also useful in playing through the green, when the ball lies in a tolerably good position. It should be grasped firmly with the left hand at the extreme end, the right being held loosely to act as a guide, both hands being kept close to each other, the wrists easy, and the thumbs over, not along, the shaft, while the knees should be a little bent. Then the club should be drawn slowly back over the right shoulder, but without touching it (Fig. 1), and brought smartly down to the ball—the swing describing three-fourths of a circle. The ascent can scarcely be too deliberate, or the descent too rapid. But during the operation the eye must remain steadily fixed upon the ball, else it will either be missed altogether or struck on the top. No attempt must be made to press the shot, which is always fatal, as sureness of aim and farness of flight are more the result of art than strength. These conditions lie at the foundation of style, and patience and attention will soon carry them into successful practice. But of no less importance is the manner in which the ball is addressed. This depends on the stand. The feet should be from thirty to thirty-six inches apart, the left toe being turned in slightly in front of, and nearly opposite to, the ball. A careful study of the proper position will prevent the ball being sent off the course to the right, by standing too near it, or to the left, by standing too far from it.

The *cleek* is a stiff-shafted club, with a straight-faced iron head, sloped backwards. It occasionally acts as substitute for the more unwieldy sand-iron,

in extricating the ball from gravel-pits, furze, bushes, and similar hazards; but its chief glory is that, being the handiest tool of the lot, it can be made to do duty for them all. Many beginners rely upon it exclusively in their early efforts, as they can strike with it more confidently than with a wooden club, while it gives them a comparative immunity from breakages. Yet in its legitimate sphere it requires rather delicate handling, for the niceties of which no printed instructions can be rendered available.

The *putter* is rightly regarded as the deadliest weapon in the golfer's armoury, as it has decided many a hard-fought contest. Thirty-six inches long, it should possess an absolutely stiff, slender, upright shaft, slightly curved, with a medium head, broad-faced, and weighted with plenty of lead to insure steadiness. This club comes into play as the hole is approached, and necessitates dexterous manipulation; as not only has distance to be judged, but the undulations of the ground and the impeding force of the grass have also to be calculated. At this crucial stage in the game the position of the player is the reverse of that prescribed in driving. Having viewed his line, he should lean on his right foot, which should be immediately opposite the ball, the left toes being turned outwards (Fig. 3). The arms should never be brought into requisition at all, the wrists being the prime motors, and the stroke should be delivered with combined celerity and decision. To hesitate here is to be lost. No timidity should mar the chances of

Fig 3.—PUTTING.

a "putt." It cannot be too strongly impressed upon the novice that he commits a greater mistake in stopping short of the goal than in going beyond it. There is no sounder saw of the links than "Never up, never in."

The costume of the golfer is simple enough. A cap, a jacket or short-sleeved roomy shooting-coat, loosely-fitting trousers, woollen socks, and strong boots, are the staples of his wardrobe. Cricketing shoes are a nuisance; and as a safeguard against slipping, too many rough nails in the soles are worse than having none at all. A good waist-belt is preferable to braces, which do not give the muscles of the shoulders sufficient freedom. Discarded white kid gloves will prevent blisters arising from the friction of the clubs; but the left hand only stands in need of such protection, and the fingers of the glove may be cut off below the second joint with advantage.

Having explained how a game at golf is played, the clubs that are absolutely required, the kind of ball used, and the costume of the player (should he care to don it), besides the nature and features of the "course," it is now necessary to supply the rules of the game. Those here given are the rules prescribed by the Royal and Ancient Club of St Andrews, which are universally recognised as the standard golfing code, and, subject to slight local modifications, can be easily adapted to any green. The beginner should, therefore, carefully study them before attempting practical work, as they contain many useful details and suggestions, especially as to the manner of playing the game, which will be found to

explain several points of the play that (to avoid needless repetition) were not entered into at length in the foregoing description.

RULES FOR THE GAME OF GOLF.

I. Mode and Order of Playing the Game.—1. The game of Golf is generally played by two sides. Each side may consist either of one person or of two, who play alternately. It may also be played by three or more sides, each playing its own ball. 2. The game commences by each side playing off a ball from a place called the *teeing ground*, for the first hole. In a match with two on a side, the partners shall strike off alternately from the tee; and the players opposed to each other shall be named at starting, and shall continue in the same order during the match. The player entitled to play off first shall be named by the parties themselves, and his side shall continue to lead off, till they lose a hole; and although the courtesy of starting is generally granted to captains of the club and old members, it may be settled by lot or toss of a coin. 3. The hole is won by the side holing at fewest strokes; and the reckoning of the strokes is made by the terms *odds* and *like*, *two-more*, *three-more*, *one of two*, &c. 4. The side gaining a hole shall lead at the next (except at the commencement of a new match, in which case the winner of the previous match is to lead), and is entitled to claim his privilege and recall his opponent's stroke should he play out of order. This privilege is called the *honour*. 5. One round of the links is reckoned a match, unless otherwise stipulated. The match is won by the side which wins one, or more holes, in excess of the number of holes remaining to be played. 6. If, in a double match, a player shall play when his partner should have done so, his side loses the hole.

II. Place of Teeing and Playing through the Green.—7. The ball must be teed within the marks laid down by the Conservator of the Links, which shall be considered the "*teeing-ground*." The balls shall not be teed in advance of such marks, nor more than two club lengths behind them. 8. A ball played in contravention of this rule may be recalled by the opposite side. 9. After the balls are struck off, the ball furthest from the hole to which the parties are playing must be played first. No player shall play his teed ball till the party in front have played their second strokes; nor play on to the putting-green till the party in front of him has holed out.

NOTE TO RULE II.—9a. It is requested that when a party is waiting to approach the hole, the party that has "*holed*" out will not cause delay by trying their puts over again.

III. Changing the Balls.—10. The balls struck off from the tee must not be changed, touched, or moved, before the hole is played out (except in striking, and the cases provided for by Rules IV., V., VII., VIII., IX., XIII., and XVI.); and if the sides are at a loss to know one ball from the other, neither shall be touched without the consent of both.

IV. Lifting of Break Clubs.—11. All loose impediments within a club length of the ball may be removed, unless the ball lies within a bunker; on sand; on a molehill; on a road; or other hazard; or touching a growing whin. (Rules VI., IX., and XII.) 12. When a ball lies in a bunker, sand, or any other hazard, there shall be no impression made by the club whilst addressing the ball, nor sand nor other obstacle removed "*before striking at the ball*." 13. A ball lying on sand, sprinkled on grass on the course for the preservation of the links, shall be treated as if it lay on grass. 14. On no occasion is it allowable to press down any irregularities of surface, to improve the lie of the ball. 15. When a ball lies near a washing-tub, or implements used in the up-keep of the links, they may be removed, and when on clothes, the ball may be lifted and dropped behind them, without a penalty.

V. Entitled to see the Ball.—16. When a ball is completely covered with fog, bent, whins, &c., only so much thereof shall be set aside as that the player shall have a view of his ball before he plays, whether in a line with the hole or otherwise. 17. Nothing that is growing may be bent, broken, nor removed, except in the act of striking at the ball, or in the special occasion provided for in par. 16. 18. A ball stuck fast in wet ground or sand may be taken out and replaced loosely in the hole it has made.

VI. Clearing the Putting-Green.—19. All loose impediments, except the opponent's ball, may be lifted on the putting-green. 20. The term "*putting-green*" shall be considered to mean those portions of the links devoid of hazards within 20 yards of a hole.

NOTE TO RULE VI.—20a. When ice or snow lies on the putting-greens, parties are recommended to make their own arrangements as to its removal or not, before commencing their match.

VII. Lifting Balls.—21. When the balls lie within six inches of each other, in any situation, the ball nearer the hole to which the parties are playing must be lifted till the other is played, and then placed as nearly as possible in its original position. Should the ball furthest from the hole be accidentally moved in so doing, it must be replaced without a penalty. The six inches to be measured from the nearest surfaces of the balls. 22. In a three or more ball match a ball in any degree lying between the player and the hole must be lifted as above, or, if on the putting-green, holed out.

VIII. *Ball in Water*.—23. If the ball lie in water, the player may take it out, change it if he pleases, drop it, and play from behind the hazard, losing a stroke.

IX. *Rubs of the Green and Penalties*.—24. Whatever happens to a ball by accident, such as being moved or stopped by any person not engaged in the match, or by the fore caddie, must be reckoned a "Rub on the Green," and submitted to. 25. If, however, the player's ball strike his opponent or his opponent's caddie or club, or is moved by them, the opponent loses the hole. 26. If the ball strike himself or his partner, or either of their caddies or clubs, or is stopped by them, or if, while in the act of playing, he strikes the ball twice, the player loses the hole. 27. If the player, or his partner, touch their ball with the foot or any part of the body (except as provided for in Rules IV., V., VII., and VIII.), or with anything except the club, his side loses a stroke. 28. If the player, whilst addressing himself to the ball on any occasion, except at the tee, touch it so as to cause it to move, or if his hand, foot, or club, touch a bent, stick, or anything which causes the ball to move, or if the player's caddie move the ball, he loses a stroke. 29. A ball is considered to have been moved if it leaves its original position in the least degree, and stops in another; but if a player touches his ball so as to make it merely oscillate and not leave its original position, it is not considered to have been moved. 30. If a player or his caddie strike the opponent's ball in any manner, that side loses the hole; but if he plays it inadvertently, thinking it is his own, and the opponent also plays the wrong ball, it is then too late to claim the penalty, and the hole must be played out with the balls thus changed. If, however, the mistake occurs from wrong information given by one party to the other, the penalty cannot be claimed, and the mistake, if discovered before the other party has played, must be rectified by replacing the ball as nearly as possible where it lay. 31. If a player's ball be played away by mistake, or be lifted by any agency outside the match, then the player must drop it; or another ball, as near the spot as possible without any penalty. Should this occur on the putting-green the ball may be replaced by hand.

X. *Ball Lost*.—32. In match playing, a ball lost entails the loss of the hole. Should the ball not be found within ten minutes, the opposite side can claim the hole.

XI. *Club Breaking*.—33. If, in striking, the club breaks, it is nevertheless to be counted a stroke, if the part of the club remaining in the player's hand either strike the ground, or pass the ball.

XII. *Holing out the Ball*.—34. In holing, no mark shall be placed, or line drawn, to indicate the line to the hole; the ball must be played fairly and honestly for the hole, and not on the opponent's ball, not being in the way to the hole; nor, although lying in the way to the hole, is the player entitled to play with any strength upon it, that might injure his opponent's position, or greater than is necessary honestly to send his own ball the distance of the hole. 35. Either player, when it is his turn to play, may remove, but not press down, sand, or worm heaps, lying around the hole, or on the line of his "put;" but this must be done lightly by the player or his caddie, with the hand only. Except as above-mentioned, or when the player is in the act of addressing himself to his ball, the putting-line must not be touched by club, hand, nor foot. If the player desires the "line to the hole," it may be pointed out by a club shaft only. 36. If, in holing out, the ball rest upon the flag-stick in the hole, the player shall be entitled to have the stick removed, and if the ball fall in, it shall be considered as holed out; but either party is entitled to have the flag-stick removed when approaching the hole. When a player's ball rests on the lip of the hole, his opponent, after holing in the "odd" or the "like," shall be entitled to strike away the ball which is at the lip of the hole, claiming the hole if he shall have holed in the "like;" and the "half" if he shall have holed in the "odd." But no player shall be entitled to play until his opponent's ball shall have ceased rolling.

XIII. *Unplayable Balls*.—37. In Match playing every ball must be played, wherever it lies, or the hole be given up, excepting where otherwise provided for. (Rules IV. and VIII.) 38. If a ball lies in any of the holes made for golfing, or on ground under repair by the Conservator of the Links, it may be lifted, dropped behind the hazard, and played without losing a stroke. 39. In all cases where a ball is to be dropped, the party doing so shall front the hole to which he is playing, standing behind the hazard, and dropping the ball behind him from his head.

XIV. *Asking Advice*.—40. A player must not ask advice about the game, by word, look, or gesture, from any one except his own caddie, his partner's caddie, or his partner.

XV. *Parties passing each other*.—41. Any party having lost a ball, and incurring delay by seeking for it, may be passed by any other party coming up. 42. On all occasions a two-ball match may pass a party playing three or more balls. 43. Parties turning before going the whole round must let any two-ball match that has done so, pass them.

XVI. *Balls Splitting*.—44. If a ball splits into two or more pieces, a fresh ball shall be put down where the largest portion of the ball lies; and if a ball is cracked the player may change it on intimating his intention of doing so to his opponent.

XVII. *Breach of Rules*.—45. Where no penalty for the infringement of a rule is specially mentioned, the loss of the hole shall be understood to be the penalty.

In reducing these laws to practice it must be explained that when both parties hole the ball in the same number of strokes, the hole is halved, and counts to neither. Obviously, whoever gains the majority of holes wins the match, which may be finished, however, without completing the round, if one of the sides has placed more holes to its credit than remain to be played. You are said to be "dormy" when it is impossible for you to lose, as, for instance, if you are two holes ahead and there are only two to play, because, even should your adversary win the last two, the match would be drawn. Disparity between the competitors is balanced by "odds," which serve the same purpose as points in billiards—the less skilful getting a stroke to every hole, or every second or third hole, as the case may be. The advantage lies here, that if the ball is holed by each in six strokes, the player receiving the odds gains that hole by deducting his allowance; or if he takes seven to his opponent's six, it is halved.

In conclusion, it may be desirable to point out that the game of golf ought to be played on links, commons, or downs that are not very much frequented, as cases are on record where serious injury has resulted to persons who have accidentally received a blow from a golf ball. In the event of the game being played over a common for the first time, it would be as well to ascertain beforehand that the local authorities would not interfere with the players on those greens where the "right" to play might be called in question. The aspirant to golfing delights and honours should (if he can manage it) make his *début* under the auspices of some one familiar with the game, not necessarily a professional. With such help his progress will be more satisfactory, and he will, doubtless, also avoid faults of style which once acquired are apt to grow incurable.

POLO.

It is only within the last few years that Polo has been brought over to Great Britain from India, where it had for some time been a favourite amusement with the officers at all suitable stations. It may be very readily described by saying that it is a game of hockey on horseback—or rather on pony-back, for the players must be mounted upon animals which are at once more readily turned, and less easily frightened than a horse. The ground required for this sport must be larger in size than a field which would do for hockey; and it should be of level turf, without swampy places or intersecting roads. A space of 120 yards in length, and 70 in width, is the smallest that should be used; and it is far better if a ground can be secured of double that size. In the middle of it, at each of the two ends, will be placed the goals, as at football; and it is, of course, the object of each side to drive the ball between the posts marking the adversary's goal.

The great attraction of Polo, which has made it much more popular amongst those who can afford to play it than hockey, is to be found in the horsemanship which is required of the players, as well as their quickness and accuracy in hitting the ball. The stroke is made with a long club (Fig.), which the rider holds in his right hand, as he guides his pony with the left, and is generally a hard one, for if attempts to "dribble" the ball are made, the chances are that it will be lost and overriden before it has been taken as far as one good hit would send it. Both the ball and the sticks, or "clubs," as they are called, are, however, of a much larger size than in the old and well-known game which is such a favourite in playgrounds; and the game accordingly assumes a more important appearance, even independently of the fact that all the players are mounted. It will easily be seen from the woodcut that the club is much better fitted for a single hard stroke than for the other mode of play, being shaped more

like a mallet, with projections on each side of the handle, whereas in hockey it is hooked, and projects only on one side, so that the ball may be either driven forcibly forward or partly drawn and partly pushed along the ground or ice. Polo is, in short, almost diametrically opposite in its system to hockey on the ice, in which dribbling is the most important part of the game, and proficiency in keeping with the ball, and following it all over the pond, is the chief qualification of a first-rate player. There are two strokes common in Polo—the forward and the back-handed: and the latter is extremely useful when the ball is flying towards the goal, and a defender thereof, galloping after it, overtakes it in time, and by one clever back-hit, sends it away far behind his back towards his friends. The rules of Polo do not usually include any restrictions as to off side, and thus a skilful player will so place his ball as to elude the enemy, and find its way towards one of his own side. There are generally eight players on each side; and they should be distinguished by a contrast of colour in their costume, as it would be otherwise impossible in the heat of action to know friend from foe.

As for the ponies used in Polo, the chief requisites are that they should be swift, both in a straightforward course and at the turn, afraid of nothing, and obedient to the slightest movement of the rider. These, it may be thought, are rather heavy demands to make; and, in effect, a good Polo pony ought to be worth a handsome price, and much more handsome than he generally fetches in the market. For an animal which is really good for Polo must be good for almost everything else, and more especially for teaching a youngster how to ride, and how to become in all respects a good horseman. Yet it is astonishing with what rapidity and ease a Shetland pony, or indeed one of any good breed, will come to understand what is required of him in the game. After a short time



POLO CLUB.

he will learn to know exactly what the rider means by each action of his hand or knee, and need but little guiding with the rein or pulling up with the bit. It was at one time thought that

Polo might be a cruel game, and likely to put the ponies to some pain, owing to the sudden checks and starts required of them, and the chances of a knock from one of the clubs. But it is found in practice that those fears are groundless, and that if a player is, to begin with—as of course he should always be—able to ride pretty well, there is no danger of either of these unpleasant consequences. In fact, Polo ponies, hard worked in the summer, have been known to win very good races, both on the flat and over hurdles, when put into training for the winter. It is, however, most necessary for young players to take care how they make a stroke at Polo when there are several ponies together, as it would be very easy to give a dangerous blow to a comrade or his steed. The use of the left hand for wielding the club and striking with it would, if acquired from the first, give a great advantage to any one who devoted a little attention to this, while it would at the same time teach a most useful lesson in riding with the bridle in the right hand. One of the best methods for improving at Polo is to use frequently a pair of Indian clubs; for by this means the wrists, which are all-important in using the Polo club with effect, are made both strong and supple, and it becomes easier to strike not only accurately but with speed and force and confidence. Indeed, the back hit, which is made by turning the elbow and knuckles downwards and swinging the hand down sharply from near the shoulder past the knee, will hardly be learnt by merely practising during the game, unless the lesson is supplemented by others at home with a club or loaded stick.

RIDING.

EDUCATION for the saddle should precede, if possible, that of harness—for horse as well as man.

A child may begin to learn riding from the time that he has mastered his first spelling-book; but though the education may be thus early, it should not be taken to any excess, or it may stunt or deform physical growth.

Within due bounds it is not only healthful, and inculcative of nerve and self-reliance, but valuable in after life. Nevertheless, a boy who spends too many hours in the saddle instead of running after hoop and ball, and using his muscles all round, will stunt his growth and deform his legs; and a girl may similarly cripple her growth, and contract a crooked spine.

First, let the beginner learn how to take up the reins before mounting. They must be held in the left hand, knuckles uppermost (not undermost, as in driving); then, if a single rein (Fig. 1) divide the reins with the middle finger, the off or right-hand rein passing between the middle and forefinger, and the near or left-hand rein being grasped by the middle and remaining fingers, while the thumb is clenched below where the rein passes out through the top of the grasp.

Fig. 1.—SINGLE REIN GRIP.

If a double rein (Fig. 2), let the snaffle (s) be first taken up on the middle finger, and then let the curb (c) reins pass in a similar way on each side of the third finger; let the loop of the reins come out *below* the thumb, which thus divides the reins distinctly, so that the rider can discover which of the two to tighten when required, by drawing them through his left hand by means of the right. Then, with the reins in the grasp, it is safe to mount (or take a hand up, if the rider is too small to reach the stirrup).

To mount in the orthodox manner, place the left hand on the pommel, then the left foot in the stirrup, then the right hand on the croup of the saddle, and with a spring from the right foot, still on the ground, rise and settle in the saddle.

With a beginner it is best to give the earliest lessons without stirrups (Fig. 3); this teaches him to use his lower limbs to cling to the saddle, while a man walking beside him can lend a hand to steady his balance if required. The canter (though an artificial pace in the horse) should be the first alteration of pace from a walk.

During early walking lessons let the pupil keep the toes in, the leg flat, the knee tight to the saddle, gripping the saddle with the side and not the back of the calf, as well as with the knee and lower portion of the thigh.

The body should be square and upright, not stiff, as if a poker had been swallowed, but playing from the hips with each motion of the animal; shoulders square, not slouching; left hand down, just close to the pommel, right hand holding the whip (butt uppermost), just in front of the right hip, ready either to use the whip if required, or to aid the left by drawing the reins through the grasp or strengthening the pull when wanted.

Fig. 2.—DOUBLE REIN GRIP.

A few days' walking practice, *especially without stirrups*, will do much towards bringing into play those muscles which give the power of grip on the saddle, and towards teaching the limbs instinctively to adopt the postures above indicated.

Now begin to use the stirrups. For ordinary riding do not thrust the foot "home" in the stirrup, up to the instep, but rest the ball of the foot on the bar of the stirrup (Fig. 4). By this time, having learnt something of the grip of the saddle, the pupil will feel what length of stirrup he requires, and will first settle his grip, and then adapt the stirrup to the position of his foot.

If he has begun to learn with stirrups he will depend on them from the outset, and ride either too long or too short (most probably the former), and not having been obliged to rely upon his grip, may take months, or even years, in feeling, if indeed he ever do so, the position of his legs, which gives him most power over his seat.

Self-taught riders who begin to ride with stirrups usually find that they require to shorten their stirrups periodically, as they gradually acquire a grip.

Fig. 3.—SEAT WITHOUT STIRRUPS.

with limbs more or less contracting in position as they acquire the right use of them from day to day. Their seat is thus continually shifting; and they no sooner think they have acquired what they want, than they find that they can improve still more with a shorter leather and consequently stronger grip.

All this time is wasted, and the seat often spoilt permanently, by allowing the grip to follow the stirrup in the first instance, instead of making the stirrup follow the first acquisition of grip.

And now, with confidence inspired by the acquisition of grip on the saddle, and with the feet in the stirrups, heels down, toes in, it will be time to progress to a canter.

If the pupil be a child the teacher should ride or run alongside with a leading rein attached to the pony, in case the rider should lack strength to restrain the pace, and pull up when wanted. The learner should sit well up, and "give and take" with the back at each motion of the animal;

let him keep the knees tight, and hold on by them only, and not seek to support the body by the rein—that is meant to guide the horse, and to support him in case of a false step, not to support the rider.

By letting the body play gently from the hips with each motion of the horse, that unsightly bumping up and down upon the saddle, so conspicuous in the horsemanship of a "Mossoo," will be avoided.

The trot, though a more natural pace to the horse, requires, for the sake of comfort, a less natural motion on the part of the rider, and is therefore best

Fig. 4.—SEAT WITH STIRRUPS.

postponed till the latter has begun to feel more at ease at the paces of walk and canter.

In trotting, the rider should "rise" in his stirrups (Fig. 5). This means that his legs should play slightly from the knee-joint in time with the trot, raising the body from the saddle during one step, and lowering it gently to touch the saddle on the next. Slight motion suffices, and it facilitates this, both for man and horse, if the rider lets the small of his back play in a little as he rises, carrying his chest forward, and bringing his centre of gravity also forward for the instant, so as to let it be more over the line of knee and foot. If his centre of gravity lies too far back, then he adds to the strain on his legs to keep him from sitting down again before the time, and tends to make himself remedy his balance by holding himself up by his reins, a pernicious habit for both horse and man.

This play of the back should be very slight, and naturally done; not a mountebank sort of bobbing in and out of the stomach, but an easy and elegant play of the muscles of the loins, giving and taking with the action of the horse, and thus varying the position of the centre of gravity according to which part of the body at the instant supports the most weight. A

practical illustration from an elegant horseman would, however, explain more in half a minute than this description can convey to a tyro.

The rider must rise first sufficiently to allow for this play of the centre of gravity; but he must not exaggerate the action into a stand up and sit down again between each step of his horse. The feel and play of his own muscles must guide him. As before, a careful notice of the action of a good horseman

will at once open his eyes practically to what here on paper may seem a rather puzzling theory.

The time will arrive when the lad will be able to control his pony without the leading-rein, and to pioneer for himself along highways and byways. Then let him bear in mind certain aphorisms, due to the well-being of horse and rider alike.

Always "feel" your horse's mouth; do not hang on by the rein (Fig. 6), but touch lightly. If a horse is a slug, he will want to stop when pulled at; if high-

Fig. 6.—HANGING ON BY THE REIN.

couraged, then the more you pull at him the more he will want to pull at you. A light bridle-hand implies constant and instant communication between horse and rider, to direct and control. A heavy hand is like a constant cry of "Wolf!" it leaves no margin for direction when really required. Moreover, in the event of a stumble or a false step, prompt and timely support from the reins aids to shift the horse's centre of gravity farther backwards, and so to save a fall. When you pull up, do so with a firm and steadily-increasing pressure of the rein; not with a jerk—the latter spoils the horse's mouth and manners also—though you really do not seek to lift the horse's head high up, but simply to afford him a

Fig. 5.—RISING IN THE STIRRUPS.

support to his neck when outstretched in his effort to save his balance. A stumbling horse at once drops his head and neck. Pulling him up eases the weight on his shoulders, and so aids his recovery. When the neck has reached its full stretch the support of the rein is of value, to keep the weight of the neck to the back, instead of letting it once more hang from the shoulders, before the horse has fully regained his balance.

Do as you would be done by, viz., do not rattle along hard roads, still less loose stones; even if the horse is not your own, you cause him pain. If you want a horse to last you, use him fairly; a trot or gentle canter is pace enough on hard macadamised roads. The trot does not cause so much concussion to

fore legs—unless the animal is artificially high-actioned—as a much slower canter does. If you want to go faster, look out for turf or a soft piece of riding-ground.

Do not let a horse catch cold any more than you would yourself; if he is in a perspiration, and you have to stop, keep him moving gently till he cools, or have a rug put over him.

Don't give him water when he is hot; it will cause him to break out in unsightly lumps, and perhaps worse than this may happen.

Fig. 7. SADDLED AND BRIDLED:—s, Snaffle; c, Curb.

Don't be in a hurry down hill; at anything approaching a steep gradient pull up and walk, or you may both come to grief.

Don't be so vain and foolish as to keep working a horse up slyly with spur or whip, and holding him in, that he may show his action. Those who understand horses will at once "spot" you, and set you down a fool for your pains.

On the same principle, do not fret a horse with the curb, so long as you can ride him on the snaffle.

Look out where you are going; don't be star-gazing; and if a brickbat should lie in the middle of the road, don't ride at it—for choice.

If you put up at an inn, and have no servant with you, see your horse fed—trust not ostlers; they are as wise in their own generation as the unjust steward, and will not hesitate behind your back to rob Peter to pay Paul.

If you have a horse that will canter with the wrong leg (i.e., left) foremost, hold him short by the left rein, so as to bring his right shoulder forward, then touch him with the spur, and he will probably break into the right pace.

If he "shies," coax, and even lead him up to the object of his terror, that he may smell at it, and so reassure himself. Do not lose your temper with him, that only adds to his fright.

If a horse bolts, and boros his head down to get the reins free, try to get his head up by sawing his mouth with the snaffle, and then hold at him. Anyhow, do not lose your presence of mind, nor seek to throw yourself off; sit tight, and

pay extra attention to guiding him in his career; though he cannot, perhaps, be immediately stopped, he may be steered.

If a horse has a trick of taking the bit in his teeth (i.e., of taking the cheek of the curb in his mouth), pull it out with a lateral motion of your hand, low down on the rein, and in future ride him with a lip-strap.

This latter appendage is usually a safeguard.

Many horses that have no vicious intention of bolting learn the trick of protecting themselves from the pain of the curb by picking up the cheek of it with their lips, so that one side of it lies against their teeth.

See that your saddle fits your horse, is well stuffed, and does not press on his withers. Every horse is not comfortable in every saddle, any more than you would be in everybody's clothes (Fig. 7).

If your horse has any tendency to sore back, see that the saddle (after the girths have been slackened) remains on his back till he is cool.

Use a bit suitable to your horse's mouth and manners; half his manners, and with them half his value, lies in his mouth.

Don't use spurs until you have acquired sufficient seat to keep your heels down and toes in, else you may be hanging on by them, driving your mount mad, half disembowelling him, and risking your own neck.

And now, having acquired confidence and command of the horse for ordinary purposes of what may be termed "domestic" equestrianism, it is but natural that the next aspiration should be to ride to hounds.

In the case of a lad and pony it will do to turn him loose in the hunting field to follow his leaders as best he may; to stick on if he can, and to tumble off if he can't. If he is a "good plucked" one, such a *contre-temps* will not injure him, and his feather weight will fall light at the worst. Besides, he will thereby learn how to fall, an art in itself. As Asaheton Smith used to say, "Any fool can fall; the thing is to know how to fall;" and if a horseman really rides up to the motto "Be with them I will," he will often, what with a tired horse or an impracticable place, be compelled to ride for a fall, or to lose his place in a run.

Fig. 8. - FOOT HOME IN STIRRUP.

A few lessons in private, in a riding-school or in the open, will soon give him confidence; and if his heart is in the right place he will then be able to make his *début*, and gradually to improve by practical experience, without being necessitated to hold himself up to public ridicule in his earlier essays.

On some steady old fencer, who has no idea of refusing or of rushing, let him ride at his first obstacle. His "hunting" seat should not be quite the same as that which he would adopt for a long plain ride, or park parade. The stirrups should be a hole shorter, and the feet well home in them (Fig. 8), up to the instep. This will bring him well down in his saddle, and though he will lose the elasticity of ankle and instep which, with the stirrup under the ball of the foot, makes all motions of the horse, especially the trot, play so much easier upon the human frame, he will have at once a firmer seat, and avoid the risk of losing a foot from the stirrup as he alights from a fence.

Let him come steadily at the fence (Fig. 9), allowing the old hunter to take his own pace. It is a mistake to make a habit of shoving a horse fast at a fence, unless there is a chance of his refusing, or width to be cleared on the farther side. It teaches him to rush, a habit which some day, in a cramped corner, may bring him to grief, and, moreover, when by any chance it becomes really necessary to negotiate a place at a slow pace, the horse, from want of being driven, faucies

his rider irresolute, and probably refuses. Get a lead given you if you can, and it will give you confidence.

Keep the knees well in, hands down, body upright. Do not lean forward as if to see what is on the other side of the fence. Sit still till you feel the horse raise his fore-quarters to the jump; then, as he springs with his hind-quarters to project his whole body over the fence, throw your own body well back, so as not to be canted forward on to the pommel, and perhaps out of the saddle, by the concussion of his alighting.

We have known some riders, of both sexes, who from fidget, nervousness, or awkwardness, could never get themselves to swing the body well back by the ordinary motion, but always sat forward, as if trying to see where the horse was going to place his fore feet, and as a matter



Fig. 9.—COMING TO A FENCE.

of course got canted forward (if nothing worse), in an ugly and uncomfortable manner. In such cases the natural balance may be acquired by teaching the rider to strike the horse with the right hand on the haunch as he rises to his fence. The whip should not be used if the horse does not require it, but the blow struck with the open hand. This will swing the body back; at the same time the hand, striking against the haunch of the horse, will there stop, and so prevent the body from losing its equilibrium by the hand swinging round behind it unsupported.

Give the horse his head as he rises to his fence, not by dropping a slack rein (else you will jerk him in taking it in upon landing, or not take it up at all, and so lack control), but by letting the arm play quickly and freely out from the shoulder as his neck stretches out. Then, as he lands, play the arm in again, ready to control him, or to support him in case he should blunder on landing.

Fig. 10.—SETTING BACK AT THE DROP.

Do not allow yourself nervously to snatch at the rein as the horse rises, as if to save yourself from slipping back out of the saddle. That will only cramp the horse's action (for he must stretch out his neck to jump), balk his spring, and bring both you and him to grief.

An easy hurdle or two will be the scene of your first essay. When you have learned to sit still and not to show daylight over the saddle at such easy obstacles, attempt something bigger, and go sometimes a little faster at your fences, that by seeing how much ground you have cleared on the landing side, you may acquire confidence to ride at fences that involve width as well as height, brooks, &c., and may judge the pace at which to go at them. The greater your fence and the deeper your drop on landing, the more must you sit back (Fig. 10). This pre-

caution, and the tightest grip with your knees that you can muster for the instant, will not only maintain elegance and security in your seat, but will be a safeguard against your being shot unexpectedly over your horse's ears should he suddenly refuse (still worse should he whip round into the bargain), especially when you are going fast at an obstacle.

If you do fall, remember a golden maxim, *stick to your reins*, unless your horse kicks you or you are stunned by the fall.

Throw your heart over a fence, and the horse will be pretty sure to follow it. The least indecision in your own mind instils itself instantly into your action, and the horse feels that your mind is not made up. If you are undecided, too probably he will also be in the same mind. The more you ride the more will you feel how instantly and unconsciously the *will* of the rider communicates itself to the horse.

When you have gained confidence sufficient, both in your horse and yourself, to ride at ordinary fences which you know beforehand are negotiable, you will be ready to present yourself in the hunting field. Once there you will be astonished to find how, when the blood is up with excitement and example, both of you rise, literally, to your work. Hesitation and refusal should there be out of the question for ordinary and practicable fences; certainly, if you do not demur, your horse is not likely to do so for you, when he sees his own species leading him the way in which he should go.

Above all, as we have repeatedly said, the hand cannot be too light, especially in negotiating awkward, cramped, or "soft" sort of places. It is astonishing what can be done by a light hand and a heart in the right place.

To teach a tyro to ride to hounds by mere book-work would be a sheer impossibility. Lessons in that line should be practical, not simply theoretical. However, a few standard maxims may be recapitulated, and borne in mind. Some of these maxims concern his own welfare, some that of his fellows in the field.

For the sake of his duty towards his neighbours, the last-mentioned claim prior notice.

Let him keep his own line, and avoid some such fate as that depicted in Fig. 11. By that we do not mean necessarily that he is to cut out his own line for himself, or to ride straight. If neither his own powers and nerve, nor the capacities of his mount admit of it, he is welcome to ride to a leader, and to dodge in and out like a hare from field to field, if he will. But he should scrupulously avoid crossing any other rider at a fence, or attempting to take an obstacle at a time and at a place that is not his own. If the place that falls to his lot in a fence does not suit his nerves or his powers, he must at least wait till the coast is clear before he attempts to deviate from his track, and to poach upon that of somebody else who has made a more wise or fortunate selection. Neglect of this will bring himself, as well as others, to grief, and burden the perpetrator with unpopularity and most probably a good deal of uncomplimentary language to boot.

If he rides to a leader, let him keep at a safe distance in the rear, and not press upon his heels. The least that he can do in return for gratuitous pilotage is not to risk the limbs of his pilot by following him so closely that he must of necessity land upon him if the leader should fall at a fence.

Fig. 11.—KEEP YOUR OWN LINE.

Also let him remember (1) not to head the fox, (2) nor to halloo until the fox is well away, else he will probably frighten him back into the mouths of the hounds, (3) also to keep his eyes and ears open, for his own sake and for that of public information, if interrogated, whether he has seen the fox cross a ride, or steal away; if the latter, and in the middle of a run, let him note whether the fox looks clean and fresh, or lolls his tongue, and has a draggled brush—the latter will be the hunted fox. (4) Let him beware of overriding hounds.

For his own sake the tyro should bear in mind the following rule:—

To start well from cover; this he can do without rushing off the instant he sees a couple and a half of hounds on the scent. He must give the pack time to get clear and away, and then look out for himself. If the cover is a big one he will have scope for the exercise of his judgment. He must move about, to some extent, according to the direction in which the hounds are drawing, or running, supposing that they have found, and are rattling their fox about the cover. At the same time he need not go into the reverse extreme, and gallop up and down sticky rides all the morning, till his horse has nothing left in him for an afternoon gallop, when at last the fox is persuaded to break.

When the fox breaks, knowledge of the country goes a long way. Foxes often run much the same line—the same haven of refuge being known to more than one. Some old stager, whose weight of body and years in the saddle make him cautious of ugly obstacles, is often the best indicator of line to a tyro, and is worth watching while the hounds are drawing, or are pressing their fox in cover. He will take his stand at the most likely place. If, however, the tyro, with all these precautions, loses start, and does not hear how far the fox's point may be distant; when wind is south-west, scent burning, and soil squelching, it is better not to "bucket" in pursuit. If the gallop is to be short, he will have no time to catch the hounds before they stop; if it is to be long, he will reach the pack at last, only to retire again with a pumped-out horse. Better follow in the line, and wait his chance, when he sees far distant flashes of pink hurrying to his right or left, indicating a turn in the line; then let him cut the corner, and so regain his place.

The old standard rule when crossing a plough parallel, and not at right angles to, the furrows, is to ride down the top of the furrow, or rather of the ridge between the furrows. Being better drained than the gutter, it is presumed to be better going. However, in our opinion this depends to some extent upon circumstances, and the rider must let his eye and geological experience, if any, guide him in his choice. In stiff clay soil, after heavy rain, the gutter of the furrow is often more favourable than the top. The horse's feet sink deeper, it is true, but the soil in the gutter is more liquefied and less tenacious than at the top of the ridge. One foot depth in "gruel" is less holding than half a foot in thick "jam."

At water the tyro must go his best pace, and with his heart already on the right side of the obstacle, else his horse is pretty sure to divine the least hesitation of purpose in his rider, and refuse accordingly, in an annoying manner, on the brink. Most brooks have rotten banks and rat-holes in many places, and as a horse does not calculate upon such, but times his landing (even if he can cover more than the distance in view) to alight just clear of the water, he may come to earth, or even subside backwards into the water on landing on such ground. It is best, therefore, to glance round for a second, and choose a dry spot before putting his head at it.

Timber is always best negotiated slowly; there is usually no ditch on the far side to be cleared, so pace is no desideratum, and though low timber can be negotiated fast, so far as safety is concerned, yet to do so is to teach the horse to rush generally at timber, instead of approaching it slowly, timing his distance, and reserving all his powers for vertical rather than horizontal spring.

Avoid unnecessary fences; when hounds are running, horse and man have enough to do without going out of their way to court obstacles. When hounds are jogging from cover to cover it is principally the rough-riders, dealers, and farmers, who have young ones to school and sell, who "lark" over fences in sight of the field. Those also who have hired for the day, and want to make sure of their two guineas' worth, will probably play the same tricks, but only the horse gains in reputation, the man is looked upon as a fool for his pains by business-like sportsmen who have come out to see hounds meet, and not simply to air horsemanship, as if to show that they were not such fools as they look. If a gallop, with a certain modicum of fencing, is all that is required, better confine oneself to drags, aniseed, and red herrings, a pursuit that can be followed for as many shillings as a pack of hounds cost pounds in the year.

Even if the tyro is not timid, and is proud of his progress, let him beware lest he earn the dubious praise which old Jem Hills bestowed on Oxford undergraduates, who larked annoyingly on the heels of his pack on cold scenting Heythrop clays—"Lord bless 'em! they fears nothing 'acause they knows nothing."

Not only for the sake of your own purse, but still more for that of humanity, even if money is no object, be merciful to your horse. Even if you are riding a livery-stable hack, whose hire covers risks and injuries, gratuitous neglect is inexcusable and unsportsmanlike. Granting that your own dinner-hour is due, house six miles distant, still that is no reason why you should grudge ten minutes' delay for a bucket of gruel and feed for the faithful slave who has toiled under you all day, and who, after eight hours and upwards with you in the saddle, begins to flag from weariness and emptiness of stomach. By the time he reaches home, without sustenance meantime, he may have gone too long to relish his corn, and may be off his feed for the next few days, unless you give way now to his necessities. Granting he is not yours, and the loss is someone else's, still you have a character for humanity and as a sportsman at stake. Many horses will drink warm beer, with or besides gruel, after a hard day; some will even relish "Old Tom" in the same way, others will loathe it, but when they will take it by all means let them have it.

On similar principles do not grudge a slow journey home, or to the nearest blacksmith's, if you have cast a shoe. It is sheer brutality to rattle a bare-hoofed horse home, and to injure him, perhaps permanently, to save half an hour's delay for your own dinner.

At the same time, beware of letting a very tired horse get stiff and chilled on his way home, especially if frosty air sets in after sundown. The sudden chill, especially in crossing an exposed upland, may paralyse the action of the heart, and make him sink from exhaustion, whereas, had he been warmly clothed at the moment with your mackintosh coat across his loins, he could have crawled home safe to his stable. We speak in such a case of a horse when too tired to raise a trot to keep up his circulation.

But though care should thus be taken not to suffer the circulation of a tired horse to become chilled and stopped, the owner should be careful not to put a distressed horse into a warm stable. The more air the animal has the better in such a case. If his body is well clothed, the windows and doors are best kept open till his exhaustion passes off.

With these final remarks on the duties of a rider in the field to his neighbour, his horse, and himself, we leave the tyro to do his best to improve by practical experience the concise teaching on the subject which is all that our space can admit of.

DRIVING.

THERE is now no branch of a lad's outdoor education of greater importance, not only to himself, but also to others, than that of an ability to "handle the ribbons." Not a bagman, small tradesman, or man of business, but would be ashamed to say that he was incompetent, if in fair health and strength, to pilot his own "trap." And yet, though so large a proportion of society,

aristocratic and bourgeois alike, can boast a smattering of the science, there is no pursuit in which perfection is proportionately so rarely attained.

The first requisite for a tyro is to learn to sit well (Fig. 1), and so to acquire the proper scope for his own power over his horse.

The seat should be above, or at least on a level, with the horses' heads, not below them; and it should, moreover, be so placed that the driver can use his legs and feet to restrain the pull of the horses if necessary, and that cannot be done if the reins pull down over the splash-board into the driver's lap.

Though most tyros begin their essay with a horse in single harness; yet in a general way it is easier and safer to drive a pair than one. If the single horse is

perfect in manners, all that has to be learned is to keep him straight; and to direct him without collisions. But if a horse has faults he is safer with a companion; though if the two have coincident faults, or could confabulate mischief together, they would be more dangerous than a single animal, yet it is in practice long chances against the two both doing wrong simultaneously. Each is a check on his fellow: the one may not want to bolt when the other does, or if one falls the other will probably keep his legs.

The tyro should take his seat uprightly and squarely, plant his feet well in front of him, grasp his reins firmly, and let his left arm play lightly from the shoulder (not the elbow), his elbows both well squared. Nothing looks so slovenly, or entails such waste of necessary power, as a slouching back, and hands sunk in the lap.

The whip should not be always used because it is handy; it is wanted to make a horse take hold of his collar if he shirks, and to feel his bit if he hangs back when there is difficulty in navigation. Unless he runs up to his bit there is little or no communication between him and his driver. The whip should be used from the wrist, not from the arm; a lash delivered from the shoulder is far less effective and much more ugly than a stroke from the wrist. A good fly-fisher never makes a bad whip in this respect.

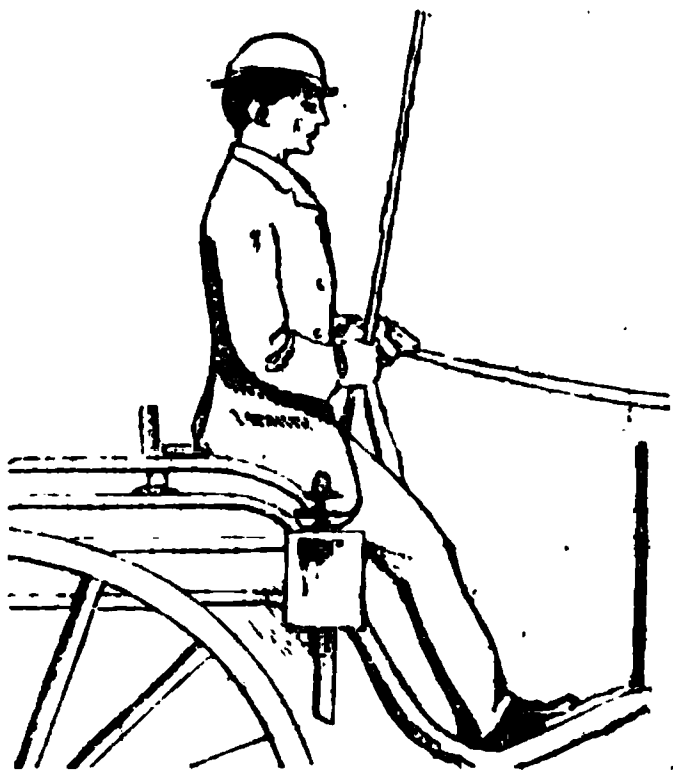


Fig. 1.—A GOOD SEAT.

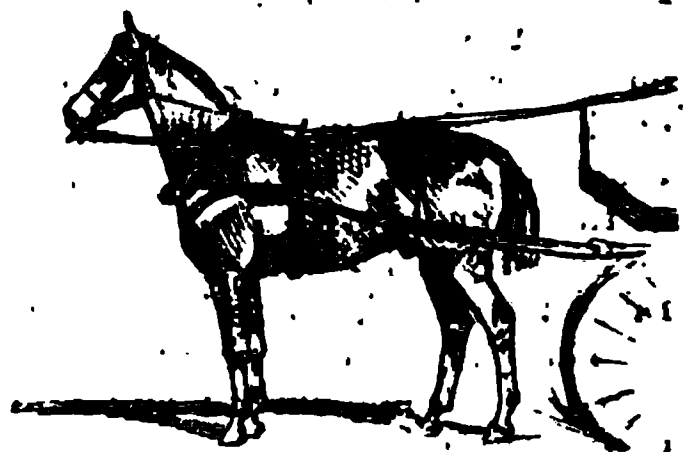


Fig. 2.—HARNESSED.

Let the beginner commence by casting an eye over his harness (Fig. 2); at first, rather that he may learn by inspection the place for everything and that everything is in its place; but later, when he has passed his apprenticeship, he should still do the same, and this time with a master's eye, to see that nothing is wanting before he mounts to his seat. Let him note that the breeching, if in single harness, is neither so loose as to be useless, nor so tight as to hamper the action of the horse and to rub the hair off. Let him see that the rein is on the proper bar of the bit; else, if the horse has been accustomed to be driven from one bar, and his biting is suddenly altered, his manners will probably change at the same time. If he is driving double harness, let him note the length of his traces, and see that his horses are properly "poled up," else the carriage will overrun them down hill.

In very light single two-wheel harness, breeching is sometimes dispensed with, and the holding back done from the saddle. It looks more elegant, and shows more of the horse; but of course it adds to the wear and tear of his fore-legs down hill, by throwing the whole weight of retention upon them, instead of letting the hind quarters bear their share with the breeching; and with a heavy load such a system is unsafe, however good the horse may be on his fore-legs.

Having cast a careful glance round his harness, the driver will then proceed to mount.

Fig. 3.—TAKING THE REINS
IN HAND.

Let him take the reins in his hand before he mounts the box, then, when seated, let the "near" or left-hand rein (N) pass between the forefinger and thumb, the "off" or right-hand rein (O) between the fore and middle fingers—palm of the hand uppermost (Fig. 3). Then let the grasp of all the fingers close tightly on the loop of the rein, which should pass out under the remaining fingers. Though the grasp should be tight the touch should be light; let not the exercise of the muscles of grip confuse the driver into adding to this a tug from his shoulder upon his horse's mouth. However light a horse's mouth is, or supposing he is a slug that does not take his collar and run up to his bit, still the driver should always feel the mouth, else he has no control over him in sudden emergency, if the reins are hanging loosely. There is more danger in driving a sluggish or dead-mouthed horse in a crowd than a free goer. The latter runs up to his bit at once, and so feels your orders; the slug does not feel, and may interpret a touch of the reins to direct him into an order to stop in the teeth of a Pickford's van, or on a level railway crossing in sight of an express. Whipcord must keep a slug to his collar, and so to his bit, or the absence of constant communication between his mouth and his driver's hand may lead to collisions.

And now in the seat, and the grasp of the reins first secured, let the tyro make a start; not in a hurry, not with an instant dose of whipcord—a word of encouragement to his horse should suffice at first. Let him learn to allow free room for his own wheels in turning corners or passing obstacles: he has got two things to provide for, his vehicle as well as the horse. Better give a wide margin at first than collide; though before long his eye will guide him, and he need not then make himself conspicuous as a greenhorn by giving too wide berths at corners and rencontres. Go steadily round a corner; remember there is such a thing as centrifugal force; and a two-wheel vehicle, high hung, may easily be upset to the outside by a hasty whisk round a sharp corner, even without the help of a bank to lift the inner wheel.

Then, as to the rule of the road. If he meets anything coming the opposite way, he must take it on his right hand; if he overtakes it, on his left; if he is overtaken he must keep to the left, and be passed on the right.

"The rule of the road is a paradox quite,
For if you go right you go wrong, and if you go left you go right,"

is an old saw which he may bear in mind as implicitly as do sailors the rhymes which tell of the rule of the road at sea.

Down hill he should progress carefully, especially when on two wheels, for then the extra weight of the cart hangs on the pad or saddle on the horse's back. A stumble and fall will probably break the shafts, certainly cut the horse's knees, and may pitch the occupant over the splash-board. Let him hold well in, sit well back, play firmly and lightly with his hand, ready to hold up sharply in event of a stumble. Even a sure-footed horse may make a false step from the pain of a loose, sharp-pointed bit of stone cutting his frog. A judicious and timely support from the rein may save the horse and preserve his balance, by thus suddenly shifting part of the weight of his head and neck on to the carriage itself.

Next to a powerful seat, the mouth of the horse and the lightness of the hand upon it are the requisites. "Half the value of a horse is in his mouth" is an old maxim. Few owners are aware how much "manners" depend upon the biting and handling of a horse. Shifting the rein from one bar to another makes all the difference in the going of the horse. The mouth is the link of communication between him and his driver; the bit must control him without fretting him, and the touch of the hand, unless light, deadens its own injunctions.

As the whip progresses in his craft, he will note many other minor details, apart from mere safety, which conduce to the welfare of his horse and carriage also. Though he is bound by rules of road at rencontre, he may choose his own path when all is clear; he need not take his share of rolling into shape newly-laid stones, if a smoother passage presents itself. Even if he cannot altogether avoid stones, he may yet ease the draught if he can manœuvre only one wheel on to a smooth surface.

FOUR-IN-HAND AND TANDEM DRIVING.

For the benefit of the aspirant to four-in-hand or tandem driving, we may append the following explanation of how to hold his reins.

Let him take up his reins thus (Fig. 4) :—The near leader's rein (NL) between his thumb and forefinger, the off leader's (OL) between fore and middle, the near wheeler's (NW) between fore and middle, the off wheeler's (OW) between middle and third fingers. Thus, the forefinger parts the leaders' rein, the middle finger the wheelers', the near or left-hand rein in each case uppermost. (We have seen the driver of a mail, and more than one horsebreaker, adopt a different grasp, viz., the wheel reins as before, the leaders divided by the three centre fingers of the hand, so that the off-leader's rein passes between the third and little fingers, the other three reins in the same places as in the grip we first described. But this last grip, though it

Fig. 4.—THE FOUR-IN-HAND GRIP.

separates the reins with a little more clearness than the former grip, exercises but little power over the off-leader's rein, and is therefore not to be recommended, and, in fact, may be styled unorthodox. That first described is the only grip to be adopted.)

Once on the box, he must take up his reins to suit the mouths of each of his team, and when he has once got the proper feel he should never part with it. If his horses are overdoing it, and require a stronger pull, he must not pull all the reins through his hands at once. If he does, ten to one he will lose the feel he has taken so much trouble to acquire. Let him take the reins into the parted fingers of his right hand firmly, an inch or two in front of his left, and then pass his hand in front and grip once more. Thus he retains his feel, with a stronger pull than he had before.

In selecting his horses for their places he should, of course, choose strong animals for wheelers; at the same time his leaders should always be fast trotters, and should be such that, with the lighter work they have to do, they will never tire before the wheelers. A tired wheeler may be dragged home by the rest of the team, but a tired leader blocks the whole concern.

In regulating his speed, or increasing his pace, he should first bring his wheelers up to his leaders; and the latter will soon get away in their turn, but he should never begin by forcing the leaders away from the wheelers.



Fig. 5.—A SLOVENLY LASH.

The handling of his whip will be a special study in itself, and he must devote some patient hours, standing on a chair, to acquiring the proper play of the wrist before he can be a workman in this respect. His lash, when not in use to hit a leader, should be caught at the point in the fingers of his right hand, as it returns from the stroke, and with a turn of the wrist should instantly be twisted, from the point upwards, round the crop of his whip, so that the surplus lash, from the top of the crop to the end of the twist, hangs in a close double thong from the top of the stock, ready for application to the leaders. Nothing looks so slovenly as to see a lash hanging as open as a letter U from the top and centre of the crop; added to which it is almost useless for punishment in such a position (Fig. 5). The play of the wrist, to catch the point and instantly to knit up the lash, must be a special study of itself. Always hit a leader below the bar, else it takes a dozen strokes to land one effectual punishment. Also put the freest leader on the near side, where he will be more under control.

Just as a pair of horses are safer than one, for each checks the vagaries of the other, so similarly a four-in-hand is an easier task than a tandem. A tandem leader, more than any animal, requires a good mouth, and a tight hand upon it; otherwise the whip may suddenly find him turning round and staring him full in the face, with a horse-laugh, which would be shared, at the driver's expense, by all lookers-on (Fig. 6). At the same time, since there are plenty of well-broken tandem leaders and steady wheelers to be found in livery stables and private houses, where a four-in-hand is not procurable, a tandem is a good and accessible school for an aspirant to commence upon, if, having mastered single and double harness, he seeks to soar higher.

Turning corners will be the hugbear of a tyro. He must learn to turn each pair on the same spot, letting the wheelers come up to where the leaders turned, before he attempts to turn them in the same direction. Each pair should turn in the centre of the road, otherwise one pair or the other will turn in the gutter, or thereabouts—an ugly, and possibly a dangerous, performance. A turn to the right is comparatively easy. In turning to the left, the right hand must not be stretched across to pull the leader's reins outwards, but the rein should be taken up quickly with the right hand, pulled in, and nipped at a shorter length in a loop between the thumb and forefinger of the left hand. The right hand is then liberated to steady the horses in the turn by touching the off rein, and to direct

the wheelers. So soon as the leaders have completed their turn, the left thumb is raised, the near rein slips back to its original length, which has been gripped all the time in the palm of the hand with the other fingers, and the length of the rein is *in statu quo*. But this can be shown far better by a practical illustration than by a verbal description.

If the aspirant really would be a master-hand in time, he must study his duty not only from the box, but from the harness-room and coach-house, and must

understand the tools that he is working with. He must look to his harness himself; half the manners of his team depends upon the harness they carry. He should see that his pads are well stuffed, and free from gall; that each horse is suited with his collar, and, above all, with his bit, or he will have no delicacy of mouth, and it will then be impossible to keep the team evenly to their work. Sheer whip-cord will never effect this.

Apart from the injunctions here given to those who attempt the higher branches of the art, a few standard maxims to all who

Fig. 6.—AN AWKWARD TANDEM LEADER.

essay to take a rein in their hands, or to sit by those who do, will not be out of place. Imprimis, come what may, short of horses bolting straight to a precipice, never jump from a carriage. If horses bolt, stick to the seat. If a collision or upset is to ensue, the carriage must strike the ground or the obstacle before its occupants; till it is reached, nothing can strike them. Thus, care must be taken to hold tight, lest the concussion should fling them out and they fall in the road. For one accident that occurs to persons sitting in overthrown carriages, ten happen from leaps from the same while in motion. A road conveyance has never the momentum of a railway train. Its inmates need never fear that any force of collision will so shatter it as to crush them also. The horses act as buffers to the shock. Broken glass is almost the only danger; therefore, in a runaway brougham instantly lower the windows, and then sit tight.

Learn how to put your own horse into harness, and how to take him out again. This will be of much use to the "young whip," for he will sometimes find himself in a place where no one is in attendance to take charge of his horse at the moment.

Get a gentleman rather than a groom to instruct you; the latter will probably know far less than a good horseman and whip, and will, from want of education, have less knack for teaching what little he does know. For one good rider or coachman among grooms, there are scores among gentlemen.

Avoid familiarity with grooms, and do not let study of the ins and outs of the stable induce you to cultivate stable slang and stable acquaintances.

Nothing is more undignified than for a master not to know from his own practical knowledge when a groom is right and when wrong; to find fault without much cause only gives ground for excuse for the servant when the latter is really to blame. Never to find fault, when fault exists, makes the servant practically the master.

CURLING.

KEEN ice, and a bracing day are all that is requisite to make the "roaring game" of curling perfectly enjoyable. No game affords better sport and exercise, or does more to promote good fellowship between man and man. Originally a purely Scottish pastime, curling now finds patrons in all parts of the world where the necessary climatic conditions exist. It can scarcely, however, be considered a boy's game, though doubtless many an enthusiastic curler tried his "prentice hand" when he had just entered his "teens." In making arrangements for a match, the first thing to be done is to prepare the "rink." This is a strip of ice, forty-two yards long and eight or nine wide, swept clear of snow and other obstacles. A "tee" is next to be set down at each end of the rink, 39½ yards apart; and seven feet behind each tee a small circle is to be described, from which foot-circle (as it is styled) the curlers launch the stone. Then, from each tee as centre, a circle must be struck with a radius of seven feet, and every stone which, when at rest, is not outside this circle, is to count in reckoning the points in every "head" or "end." Immediately outside, and beyond the

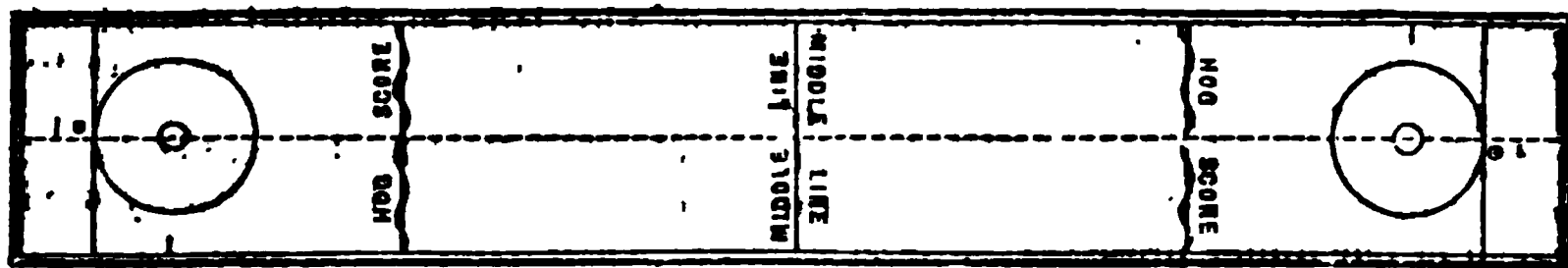


Fig. 1.—CURLING RINK.

tee-circle, a line is to be drawn at right angles to the rink, and every stone passing this boundary is considered "dead"—that is, does not count, and is removed from the ice. Seven or eight yards from each tee a line is drawn across the rink, and every stone that does not pass this "hog-score," as it is called, is removed from the ice. Half way between the tees another line, called the "middle line," is drawn, also at right angles. It may be added that no stone is considered to lie within the circle or over a line that, when at rest, is not clear of it. The accompanying diagram (Fig. 1) will explain the plan of the rink which has just been described. As to the players, a rink is usually composed of four a side, each curler using two stones, and each set of four being provided with a "skip," or director, whose duty it is to captain his set. The stones (Fig. 2) with which the players are armed are of circular shape, with flattened sides, and must not weigh more, including the handle, than 50 lb., or less than 30 lb., or be of greater circumference than thirty-six inches, or of less height than one-eighth of the greatest circumference. Each stone is furnished with a handle; so that the player may be able to grasp his weapon in order to hurl it towards with proper judgment and force. Sides having been chosen, an umpire is generally selected, to whose decision all disputed points are referred. The players are provided with brooms for sweeping the ice in front of an approaching stone, the sweeping being conducted under the control of the "skip." It is allowable for the player's party to sweep the ice from the middle line to the tee, so long as the running stone or any of the stones at rest is not disturbed, and provided that the sweepings are always brushed to the side of the rink. Need it be said that the aid of the broom is sought for the very practical purpose of removing falling snow or other impediment, and also of giving the surface of the ice the utmost possible degree of keenness, to help onwards a stone that may have been discharged with insufficient power? The

"skips" having arranged the order of the play, the business of the game at once begins in thorough earnest. The number of points ordinarily appointed as decisive of a match is thirty-one, and the side which first scores that total (or scores most in the event of both totals exceeding that number) is victorious. There is a

strong resemblance to bowls in the game of curling, and both present the same common object to the players. Their chief aim is to hurl the stone with just that proper amount of strength as will bring it within the charmed circle, and place it close to the very "tee." Then there is room, too, for a rival curler to try to drive an opponent's stone from a position of 'vantage, and to secure it himself; or he may show his skill by planting his stone as a guard to those of his set which may happen to lie very advantageously for counting. A close "finish" at curling rouses both parties to the highest excitement, producing in both players and onlookers such a hearty glow as fairly sets the bitterest blasts of John Frost at defiance. But curling is not, strictly speaking, a boy's game; yet there is no reason why lads so minded should not play it, only in that event the length and width of the rink would have to be altered to suit the special circumstances of the case.

Fig. 2.—A CURLING STONE.

The game has been so faithfully and happily described by James Grahame, the poet of "The Sabbath," that his graphic lines may here be profitably used, instead of our duller prose:—

"The sides when ranged, the distance meted out,
And duly traced the tees, some younger hand
Begins, with throbbing heart, and far o'erhoots,
Or sideward leaves, the mark; in vain he bends
His waist, and winds his hand, as if it still
Retained the power to guide the devious stone,
Which, onward hurling, makes the 'circling group
Quick start aside, to shun its reckless force.
But more and still more skilful arms succeed,
And near and nearer still around the tee,
This side, now that, approaches; till at last,
Two, seeming equidistant, straws, or twigs
Decide as umpires 'tween contending coits.*

"Keen, keener still, as life itself were staked,
Kindles the friendly strife; one points the line
To him who, poising, aims and aims again;
Another runs and sweeps where nothing lies;
Success alternately, from side to side
Changes; and quick the hours unnoted fly,
Till light begins to fail, and deep below,
The player, as he stoops to lift his coit,
Sees, half incredulous, the rising moon.
But now the final, the decisive spell
Begins; near and more near the sounding stones,
Some winding in, some bearing straight along,
Crowd justling all around the mark, while one
Just slightly touching, victory depends
Upon the final aim; long swings the stone,
Then with full force, careering furious on,
Rattling it strikes aside both friend and foe,
Maintains its course, and takes the victor's place."

* *i.e.*, the curling stones.

SKATING.

THIS is an accomplishment that one should pick up as a boy, when one has not far to fall, and not much dignity to lose, and not wait to acquire laboriously in later life, when one's vanity is more venerable, and one's bones more susceptible to hard knocks. To a youngster in his teens, or to a child even much below that age, the task is not really formidable; and the motion, once learned, is as natural as walking on dry land. But at first it must be confessed that it is anything but natural or easy. In fact, few creatures look more awkward and helpless than the beginner on skates. Terribly nervous he feels, as he first rises off his chair to a perpendicular position, and finds his feet sliding and slipping away from him in every direction except that in which he wishes them to go. What horrifies him most is the rapidity with which a skate-wearing foot, once started, makes off away from its owner. He is quite at a loss how to check this impetuosity; and, indeed, the matter is by no means easy. But let the beginner, who wishes to save himself from the extremes of bodily and mental agony, beware of new skates, as he values his skin and bones. Let him get a good old, and, if possible, rather rusty pair. Upon these he will be able to a great extent to moderate the ardour of his feet in running away, and attend to the first canons of instruction, which are these: to *turn out the toes*; to keep the weight of the body always well in front and inside of the feet; to allow one foot to complete its stride before the next is begun; and, above all, to keep the ankles stiff and firm. Without some help in the way of a friendly arm or hand, it seems at first an almost hopeless task to acquire the art. A stick is worse than useless; the hope of saving oneself by its help only aggravates the fall, and frantic efforts to dig it into the ice, or get a hold with it on the slippery surface, will be altogether fruitless. On a friend's arm you may practise keeping on one foot as long as possible. You will thus acquire more strength in the ankle, and more confidence, and become a better judge of pace.

The whole art of skating consists in a knowledge of the rules of gravity, or what is commonly called "balance." When you start you are perpetually "off your balance." As you get on, you gradually gain an intuitive practical idea of the way to "keep your balance." This is the great object. Remember, always, that by throwing the weight of the body forward you escape the risk of those terrible *backward* falls, which occur through the feet slipping away in front. If you must fall, it is much better to fall forward. Moreover, the body, in skating at all quickly, must always be a good deal inclined to the front. If the feet are well turned out, that will make it impossible for them to go far astray as long as the body is prevented from only leaning back.

Lastly, courage, confidence in the possibility of succeeding, and a resolution not to be beaten, will do as great wonders in the matter of learning to skate as we know they do in objects of more arduous and serious ambition. But in point of fact it is much more important, in this humble elementary stage, as well as in the proud art of figure-skating, to know what to avoid than what to do. In both cases nothing is easier than to pick up a bad style; nothing more difficult than to get rid of it. The most usual faults in common inside-edge skating, which is all that we have to do with at present, are these—bent knees, high shoulders, waving arms, and shuffling scratchy strokes with the feet. Avoid these failings, hold your head up and your hands down, turn your toes well out, and make long, clear, and firm strokes with each of your feet, and you will soon be master of the inside edge.

We must now say a few words as to the *selection of a pair of skates*. Out of the almost innumerable varieties, there are two which at once

suggest themselves to notice as the simplest and most generally used—that is to say, the old screw-and-buckle skate (Fig. 1) and the American lever, or "Acme" patent. The old ordinary skate is so well known as to need but little description. It has the advantage of great security, of being able to stand any amount of wear and tear, of fitting to any boot without the necessity of alteration or adaptation, and lastly, of cheapness. On the other hand, its disadvantages are that it requires a good deal of time and trouble to take on and off, that

Fig. 1.—SCREW-AND-BUCKLE SKATE.

its use necessitates the carrying of a gimlet to bore the holes in the boot-heel, that the straps used with it are apt to cramp the feet and ankles, and lastly, that the holes bored in the boot-heel will in course of time become worn, and cease to hold the screw tight when inserted into it. A woodcut of the "Acme" skate (Fig. 2) is also given, but it is difficult, by a mere engraving, or even in words, to explain its clever though really simple mechanism. It must suffice to say here that it operates, by means of a triple-acting lever, to compress its five teeth or clasps round the sides of the boot's sole.



Fig. 2.—THE "ACME" SKATE.

Three of these teeth grasp the heel, and two of them the sides of the front part. The lever, after the clasps are fixed in their place, is fastened securely and neatly by a spring snap. To detach the skate it is necessary only to push aside the spring, and, by a single motion of the lever, the skate falls off from the foot. Thus a few seconds are all that is required to put on and to take off a pair of these skates. It is quite possible for a man, skating at full speed upon one leg, to take off and put on again several times the skate belonging to the other. The advantages of the "Acme" skate, besides the rapidity with which it can be put on, are—its neat and clean appearance, and its completeness, without the need of straps and buckles and the troublesome and dangerous gimlet. Its disadvantages are—the clumsy and useless projection at the ends of the blades both fore and aft; the great height at which its framework stands above the ice, thus needlessly tiring the wearer's ankle; and a certain liability to give in some part or other under the strain of very hard wear. This last objection has been fatal to the skate in the opinion of most good skaters, and has led to the adoption

by them of the "Barney and Berry" patent, in which the teeth or clasps are fastened by a screw and key instead of a spring. The objections to almost all the other forms of skates are that they require a boot specially made to fit them.

Nevertheless, as soon as the preliminaries have been got over, and the young skater begins to be really proficient in his art, it will be found best to have a special pair of boots reserved for skating, and fitted with the old club skate, of which a woodcut is given (Fig. 3), or some other blade securely fastened to the sole by some sort of clasps. It is important that the curve of the blade, where it touches the ice, should not be too round or too flat. The most approved shape for a blade-edge is one forming the segment of a circle of which the radius is 7 feet and the diameter 14. This will be flat enough to give a good support to the foot without being so straight as to interfere with the execution of threes,



Fig 3.—THE CLUB SKATE.

double threes, and loops. Generally, the skates exposed for sale in shops are much too curved in the blade. Of course, for figure-skating, the square-heeled blade is altogether inadmissible.

Another necessary part of an article on skating will consist of some preliminary hints as to the terrible dangers that unfortunately attend upon this amusement. In the first place, then, unless he has conclusive evidence that the ice is of a perfectly safe thickness, a skater should never venture upon water which is out of his depth unless he can swim well. The mere ability to swim, however, is often insufficient without other aid. A few minutes' immersion in ice-cold water will chill the limbs and paralyse the strength of the stoutest swimmer; and unless a ladder, or a rope, or some means of escape, be close at hand, he will inevitably sink to rise no more. On all ponds or pieces of water, therefore, where the depth is in any part sufficient to drown a person, one at least of these appliances should be on the spot. Next, as to the signs by which *safe may be known from unsafe ice*. There is a common saying, "Cracks, it bears; bends, it breaks"—and to a certain extent and in certain cases this is true. Almost all ice, certainly all white ice, unless it is of an immense thickness, will crack when it covers at all a large piece of water. Sometimes, even of its own accord, with no one on it, it will burst into one of those great jagged fissures many yards in length, cracking with a sound like the explosion of gunpowder, either through the motion of the water underneath, or, like glass, from the action of the hot sun above. Oftener still, its brittle material will yield to the weight of bodies above it, and relieve the tension upon its broad surface by snapping into a sort of joint in the midst. But such cracks as these are no sign of immediate danger: the edges of the crack remain close, or almost close, together. But there is another kind of cracking, the soft quiet cracking, which may well arouse one's fears. When the fissures are of short length, and extend all over the ice like a network, when they burst with a low hissing or crushing sound, and water oozes up between the sides, then it is that they are suspicious: then is the time to take flight. It is when the ice is loaded beyond its weight, when the warmth of the sun is too strong, or when an insidious thaw has set in, that this sort of thing occurs; and when it does, let not any one who values a dry skin tempt fortune any longer. As for the ice that bends, it is true that in the case of *white* ice the bending is a most suspicious sign. It betokens usually a softness or rottenness, which is the

result of a weak frost or a gradual thaw. Such ice will often be found on close inspection to be cracked or broken up in the manner we have already described. The sound of these small cracks is hardly heard, and they spread imperceptibly, until sometimes there is not a square foot of the surface without several seams traced across it in this way. The ice, thus weakened, gives under the weight of each skater as he passes over it, and seems, as one regards it from the bank, to undulate in great troubled waves in the most alarming fashion. At last the crash comes; two or three heavy men meet together, or a fall or collision occurs, and the ice is seen sinking quietly and sulkily beneath the strain.

There is, however, another sort of ice, the *black ice*, which is made by very severe and sudden frosts, which is of quite a different sort. This is the most strong and durable ice that can be found. An inch of this black ice will bear a man's weight comfortably, if its surface is not too broad; whereas, an inch and a half is the very least that can be trusted as the ordinary rule. It is usually on rivers or on pieces of water where there is a considerable current that this sort of ice is to be found. The smaller frosts have no effect upon this kind of water, and it is only the severe "black frosts," as they are commonly called, that can cover it with solid ice. It is the ice thus formed that is termed by skaters "black ice." It is very elastic, and has the adhesive powers as well as the elasticity of indiarubber. It will bend, therefore, like whalebone, without giving way, and will crack only under a strain that shows it is being tried very much beyond its powers. Thus, when it does break, it always does so suddenly, and the danger is the greater, inasmuch as the skater, once in, may be carried off before he rises again by the current that runs beneath.

So much, then, for the sign by which safe and unsafe ice may generally be tested. We may now proceed with our instructions in some higher branches of the art. After the pains and griefs that accompany the early education of the skater, he is amply repaid for his troubles by the ease and rapidity with which he gets along when once he has achieved success. Almost every one, after a day or two's practice, finds one foot much further advanced than the other in its education. The ankle of one foot is stronger, or its skate fits more comfortably, or, in fine, it seems to have "taken more kindly" to the business. Then is the time to devote one's chief attention to the backward foot. It is all a matter of practice. From this stage, from the first moment that one can get along at all, it is experience alone that can be one's guide in learning the inside edge. The grand principle is *to keep one foot only on the ice at the same time*; the longer the better—the strokes cannot possibly be too long. And as you get to bear more weight upon the skate, it will begin to describe the proper curve *on the inside edge*. There is no fear of beginning with the wrong edge, the only thing to be guarded against is a tendency to use neither, to attempt to slide along upon the flat of the skate. This is bad, and must be avoided by turning the toes well outwards. That is the unfailing remedy: the weight of the body then throws its balance naturally on to the inside edge, and the skate, by a law of mechanics, describes a curved sweep onwards and inwards as it goes. The curve described by one stroke properly made should be about that of a quarter circle. When this is finished, the force of the stroke should about have been expended, and the other foot should be ready to be put down. The next stroke should be commenced almost at right angles with the end of the last, and thus, in a succession of quarter circles, you progress in a zigzag course, the eyes being always directed straight to the front, but the feet pointing alternately at the beginning of each stroke to the extreme right and left.

For quite a beginner, three to five yards is a respectable space to cover at each stroke. Racers do three and four times that distance at each stride, even when going at full speed. If both feet are put down at the same time, they

must be kept carefully parallel, otherwise, if they separate, each taking its own direction, the consequence is obvious—an absurd and often painful tumble.

The inside edge thus once mastered, it becomes incumbent on the skater to decide as to his further progress in the art. Three courses are open to him. He may either content himself with the inside edge pure and simple, and devote himself to hockey or other games; or, secondly, he may qualify as a "runner," or racing skater; or, lastly, he may aspire to become a cutter of figures, and graduate as a professor of the highest arts. In each of the last two cases, his inside edge skating will be a merely intermediate stage. But for the majority of games on the ice, and especially for hockey, which is the prince of them all, no greater skill is required than a knowledge of the simple inside edge. Speed, and a facility in turning rapidly or arresting one's course suddenly, are important adjuncts to the art, and they must be acquired by all who would excel. But in acquiring them, practice must be the best mistress. Those will learn the quickest who care the least for falls. *Pulling up short* is sometimes effected by a species of "putting on the drag." This is done by simply leaning heavily on the heel, whereby the back part of the skate, being driven into the ice, and having to plough its way by cutting deep into the surface, acts as a suitable "skid." It is, of course, only in skates which have the back part of their steel blade flat upon the ice, and not rounded off as it is in front, that this device can be resorted to. Those who are accustomed to use it should be very careful, in wearing a new or borrowed pair of skates, to see that the steel is not of the rounded pattern. Should they inadvertently try to stop themselves in this way while wearing skates of the latter description, the consequence will be terrible, for they are certain to get the worst fall that can possibly occur—that which happens from the feet slipping away forward, and leaving the back part of the head to come full on the hard ice.

To return, however, to our games. Hockey, in its only suitable place, on the frozen pond, is a wild, glorious, almost maddening excitement. The ball (of tough seasoned cork it should be) flies at the slightest touch, like mercury, skims like the wind over the clear bright surface, dashes with lightning speed backwards and forwards, hither and thither, in the most unexpected and ever-changing directions, under the quick blows of the strikers' sticks. No goals are necessary for the game thus played, no sides chosen, no rules as to "off-side" or "out of bounds" imposed. "All against all" is generally the rule, and each man, according to the time he can retain the ball, or drive it before him where he likes, reaps the lion's share of honours and amusement. The sole boundaries are the limits of the pond; and he who, however hard pressed, hits the ball off on to the land is justly accounted a "muff." To play the game well, speed is not the only requisite. It is, as in coursing matches, only one of the "points." Of course, there are continual races either after a ball hit far away, or to catch a competitor who is carrying it off with him. But it is not sufficient to be first up with the quarry. He is considered the best player, and gets the largest share of the game, who can manœuvre and "dribble" the ball along with the greatest cunning and foresight. "Dodging" is everything, and the knowing hands will double like hares, throwing out their followers just as puss baffles the greyhounds, and getting a fresh start and fresh breathing-time, and a good look round to choose where to go. The best players do not hit hard; it is the gentle, neat touches and turns of the wrist that guide the ball the best. As you tear along at full speed after the leader, he can throw you out fifty yards by moving the tip of his stick an inch. If he only aims his stroke properly, he can "place" his hit with perfect accuracy, and reach the spot to which he intends his ball to go, almost before you are aware of his intention to send it there. For there is no chance about the game; everything is true and regular. No billiard-table in the world is truer

than a piece of good ice; no cricket ground can compare with it. The game demands skill and activity, knowledge of pace and time, the power of racing, turning, and pulling up rapidly, and the nerve to strike straight, and to keep a sharp look-out. Yet, however interesting this game, let not hockey-players, in their excitement, spoil the figure-skaters' sport. On every pond there should be a sacred corner given up to the scientific. It need not be a large space; but it really ought to be select and safe from the noisy boisterous whirlwind of the hockey-players.

The chief dangers in this fascinating game are falling through holes or unsafe spots in the ice, stumbling over rough ice, and the snapping of a buckle or screw, while in the full swing of the fun. The two former dangers can be guarded against by the exercise of some amount of care; and as for the latter, every one should see that his skates are securely fastened when on, and well dried and slightly smeared with grease or oil when taken off.

The skates used for hockey ought to be of the very strongest and safest make; no spring that we have ever seen will bear the ordeal. The sticks should be light; but this is a needless caution, for a very short essay will show how impossible it is to play well with an unwieldy and heavy one.

Dancing on the ice might be more fashionable than it is. In many towns a band is often available; and a quadrille is capital exercise for ladies and skaters who are not quite up to the orthodox "figures." The space for a quadrille on the ice ought to be almost ten times the size of that in an ordinary ball-room. To dance the figures properly—especially the last figure of the Lancers, which is the prettiest of all—it is far better that all the dancers should do the outside edge; but even without this refinement, the dance is a beautiful sight, and, where there are ladies and music, should always be attempted. An effort is sometimes made—of course by first-rate skaters only—to get through a waltz upon the ice, but the result is not very often successful or elegant.

Such games as rounders, and the other ordinary playground sports, can almost all be played with increased zest upon the ice. Of all of them, prisoners' base is the most exciting, and a good rally at it resembles a gigantic coursing match, with a dozen hares and as many greyhounds, wheeling, doubling, racing, and dodging one another in an endless complication of circles.

Leaping on the ice is an accomplishment more rare than difficult. It is worth learning by any one who is tired of the plain straightforward skating, or who wishes to indulge in a steeplechase. To make a leap on the ice, the same motion is required as in making a standing jump on dry land. The skater must, when he is going at a tolerable pace, get his feet parallel, both upright and firmly on the ice. Then, bending at the knees, he presses downwards and springs up, keeping his feet exactly level till he alights. On alighting, the feet resume their old position, and the course is then continued. The height and width of the jump depend upon the strength of the spring, and the speed at which the jumper was going when he leaped. A very moderate performer will soon be able to clear a chair turned on its face, but we have seen as many as four chairs ranged thus in a row cleared with ease, and a railing as high as a five-barred gate taken beautifully. The great danger is the coming down, for the least alteration in the position of the feet, or in the upright position of the body, will insure a terrible and often dangerous fall.

When the skater is well practised in jumping over chairs and sticks, &c., he may actually turn his accomplishment to practical use. It is not a bad thing to be able to clear a ditch which is doubtfully safe or actually unsound. On an emergency, with the wind behind, and everything else favourable, a good jumper will clear eighteen feet of ditch, and make those who try to follow him look very foolish. Among those who can jump, steeplechases can be arranged, or a run across the floods, "taking" all obstacles *en route*.

There is only one other species of skating that need detain us before we proceed to the study of figures. This is the art of racing, or "running," as it is called by those who are proficient at it.

It is at the present day practised more by professionals than by amateurs, although there is no reason at all why it should not be equally popular with the latter. The part of England where the sport is best known is the fen country of the eastern counties; and it is hither that the most successful "runners" repair when once a severe frost has set in. Probably there is not a more severe and trying exercise in the world than racing on skates. Certainly there is none in which man, by his own unaided exertions, can attain so high a rate of speed.

The action is very much that of fast walking, and those who would excel in it must observe pretty much the same rules observed in training for a walking-race. The arms, however, instead of being held up above the waist, and close to the body, are swung violently from side to side; the legs, moreover, although they should be left as straight as possible, can never, in practice, be prevented from bending slightly at the knee. As the beginner learns to lengthen his



Fig. 4.—THE INSIDE EDGE.



Fig. 5.—THE OUTSIDE EDGE.

strokes—the great object which he must always keep in view—he will learn also to make them straighter and less oblique. Some of the best men only deviate about a yard on their alternate feet from each side of the straight line. This directness of stroke is rendered much easier by the form of the skate used, which is quite straight in the blade, without any of that curve that is to be observed in figure skates.

With regard to the pace attained by runners, there prevailed formerly the most wild and exaggerated ideas. A number of races held under responsible management have shown that the speed attainable is far less than had been supposed, and that, putting wind out of the question, a mile in four minutes must be reckoned, even amongst the best skaters, a most creditable performance.

We proceed now to figure skating, the first step in which is the performance called the "outside edge."

Skating on the outside edge means simply resting on the outer of the two edges of the skate on either foot—that is to say, on the right-hand edge of the right foot, or on the left-hand edge of the left foot—and thus describing a curve which bends outwards, instead of inwards, as was the case in skating on the inside edge. A glance at the diagrams, where the two movements are contrasted (Figs. 4, 5), will at once explain the nature of the curves.

All this sounds very simple, and it naturally occurs to the learner that by simply inclining the ankle outwards the necessary effect can be at once produced.

Unfortunately, on trying the experiment, the desired result does not "come off." It soon becomes evident that an entire change in the posture of the body, as well as in the mere position of the foot, is an absolute necessity. In effect, the principal weight of the body must be thrown outside of the perpendicular line which ascends from the edge of the skate that is on the ice. Technically speaking, the

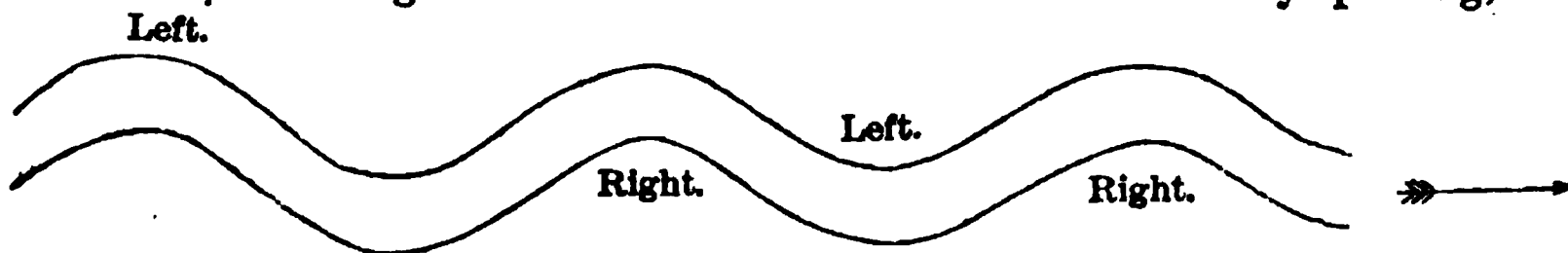


Fig. 6.—THE ORDINARY FORWARD ROLL.

line of gravity must be brought over from its natural position between the feet to a place outside of one of them. This is a distribution of balance which is required of the human figure in no other sport or exercise.

Ingenious teachers have discovered a variety of devices for helping their pupils over this grand problem. Most of them, however, need be mentioned only for the purpose of warning beginners against them.

By far the simplest, safest, and best method is the following:—Learn first to skate the *ordinary forward roll*, of which Fig. 6 is a diagram. The two feet are

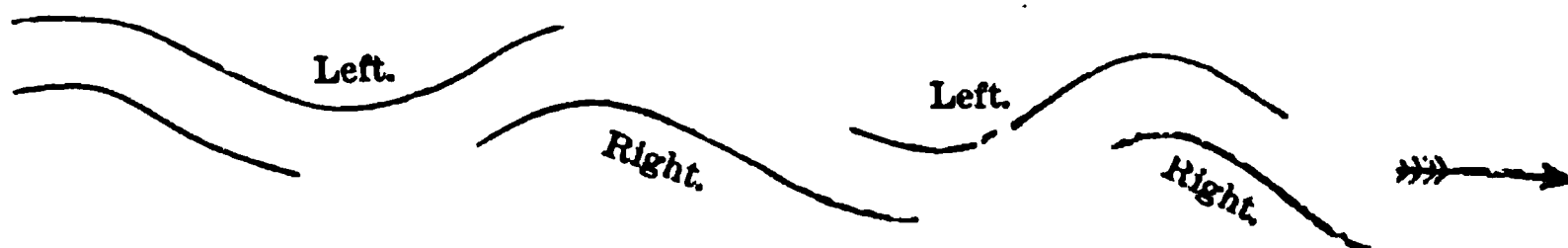


Fig. 7.—OUTSIDE EDGE: INTERMEDIATE STAGE.

kept continuously on the ice, and the skater moves forward in a serpentine course, getting his impulse by leaning from time to time alternately on the inside edge of each foot. To acquire the outside edge, begin gradually, instead of leaning, as is natural, on the foot which is doing inside edge, to rest more weight upon the other. After a bit, raise the foot which is doing inside altogether off the ice, putting it down again when there is any danger of falling.

By thus lifting each time for a longer space the "inside edge foot," you will

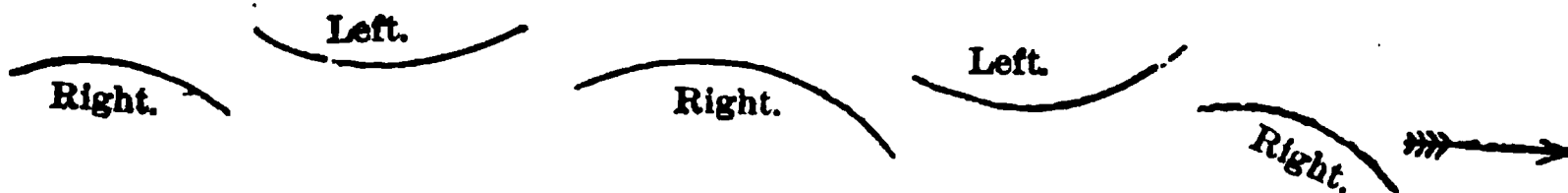


Fig. 8.—OUTSIDE EDGE: FINAL STAGE.

learn to use the other with more and more confidence, until at length whole strokes can be completed on the outside edge alone.

The progress from the first step (Fig. 5) to the third (Fig. 8), *via* the intermediate stage (Fig. 7), will be understood more easily from the diagrams.

The greatest care must be taken throughout not to allow the foot which is off the ice to get in front of the other. This is one of the most important and at the same time the least known and observed maxims of forward skating. Only on the rarest occasions, and then only for the shortest space of time, is the "off" foot to be advanced. At all other times it must be kept well back, with the toes well turned out, and the heel close to that of the other foot. This rule is,

moreover, to be observed by all who would skate gracefully in doing the inside edge.

The *other rules for outside edge* are very simple in theory, very difficult in practice, especially if a bad habit has once been contracted. They are, to hold the head well up, and keep the eyes raised and not directed downwards to the ice; to keep the whole body quite upright and the shoulders down; to abstain from throwing the arms about, and, indeed, from any violent contortions whatever of arms, legs, or body; and finally, to keep the knee of the leg on which you are skating perfectly and unremittingly straight and unbent.

The *inside and outside edges backwards* are learnt in a somewhat similar way, by practising the inside roll backwards, and, when sufficiently strong and confident, lifting up one or other of the feet, and continuing the stroke on the inside or outside edge, as the case may be, of the skate left on the ice.

He who has fairly mastered the outside edge forwards is introduced at once to the study of the "figures," properly so called; and of these the first that invite his attention are the "eight" and the "three."

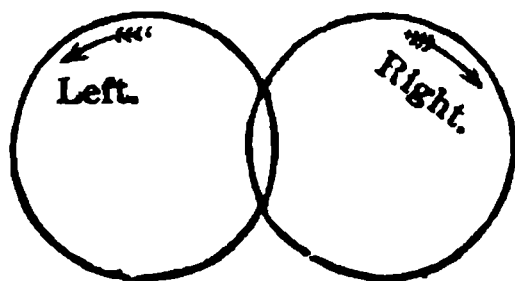


Fig. 9.—THE EIGHT.

To accomplish an eight, start on the right foot with a strong bold stroke, leaning the body rather far out of the perpendicular, so as to insure a rapid curve, and continuing that curve firmly and steadily until a circle is almost entirely completed.

By this time your impetus will be pretty well exhausted; but before you come quite to a standstill, bring the left foot (which, of course, has been hitherto held just behind the other) to the front; cross it quickly over the right toe, and as the latter completes its stroke, put the left down at an angle pointing well to the *right*; throw the whole weight of the body at the same time steadily to the right, so as to rest it entirely on the foot just put down, and thus commence another stroke of precisely the same sort, describing another circle on the left.

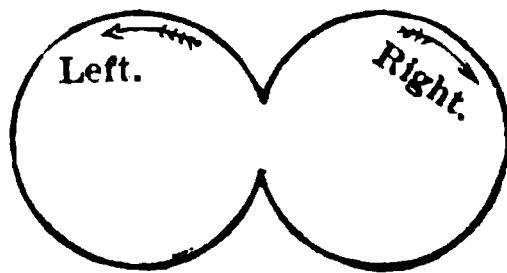


Fig. 10.—THE EIGHT.

These successive circles, all returning nearly to the same spot, constitute each the half of a very handsome figure resembling accurately the Arabic symbol 8 (Fig. 9). Of course, it is not to be supposed that the beginner will succeed at once in making the ends of the circles fit with one another. Many of the strokes will come far short of the proper distance. But disasters must not



Fig. 11.—THE THREE.

discourage him. Practice will give confidence; and the two together will triumph surely in the end. Above all, *do not look down upon the ice* to watch whether the feet are going in the right direction. Get a friend, if you like, or if you can, to stand at the place whence you started, and shape your course by looking towards him. But do not on

any account, as some do, put an orange on the ice and steer to that. The head must always be kept upright, and the eyes raised. Once let them down, and it is all up with your hopes of skating properly. The other grand rule is to *keep the circles large*; eight feet should be the *minimum* diameter of any circle, and this is much too small. The off leg which is not on the ice should be kept quite behind the other, with its heel close up and almost touching, and its toe turned very much outwards and backwards.

We have begun by describing the eight as properly skated, with the feet

crossed; but it is possible to execute a very capital eight without crossing the feet at all, as appears in Fig. 10.



Fig. 12.—THE THREE.

the turn is made, it is quite impossible to give a good explanation. The problem is to be solved only by trying it, and a very short trial will make it easy.

At first it will no doubt be necessary, as the twist is made, and the motion backwards commences, to put down the other foot upon the ice, just to steady the balance and avoid the strange and formidable feeling which such a shifting of balance must inspire. At first the forward stroke should be made long, as in Fig. 13, and the turn not made till the impetus is dying away. What is called the "tail" of the three—that is, its second half—will at first be a very feeble and straggly stroke.

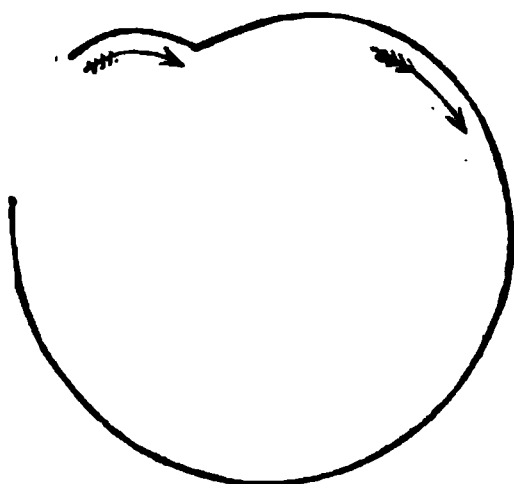


Fig. 14.—THE THREE.

The second of the elementary figures is the three—a very easy one, moreover, to learn, and to do—badly; though not so easy to do well. It consists of a half-stroke on the outside forward, followed without any stop by a second half-stroke on the inside backwards of the same foot (Figs. 11, 12, 13, 14). Of the peculiar jerk, or rather shift, whereby the motion forwards is suddenly reversed at the point where



Fig. 13.—THE THREE.

Soon it will become stronger and bolder; the turn may then be made earlier; and at last the forward stroke may become merely a tiny introductory step leading up to the long rounded sweep of Fig. 14.

The attitude in skating is half the battle: in the first place, a straight knee throughout—terribly difficult this one requisite; secondly, the absence of jerks and whirlings of the arms; thirdly, a perfectly clean-cut edge to the angle where the turn is made; no scraping of the ice with the flat of the blade; no loops; no swinging of the legs.

From the simple threes it is a short step to the double and triple, and even quadruple threes. In short, the complications of edges practicable by the double and "half-double" threes are endless. And the skater must so manage his balance as at any time to be able to shift from either edge forwards or backwards to the reverse edge in the other direction.

The annexed figures show a double three (Fig. 15), a half double (Fig. 16)—the most difficult—and a triple three (Fig. 17) on the right foot. By multiplying the turns, and making each forward and backward stroke equal in size, a figure is achieved which goes by the name of the "rose" (Fig. 18).

We arrive now at a totally new stage, that of "edges"—technically so called—that is to say, the practice of changing from one edge to another without altering the foot or the speed. A perfect skater must be able in a twinkling, at the tenth part of a second's warning, to change from the outside to the inside, or back again, without difficulty or even apparent effort. The most difficult "edge" of all is the turn from inside to outside backwards, and

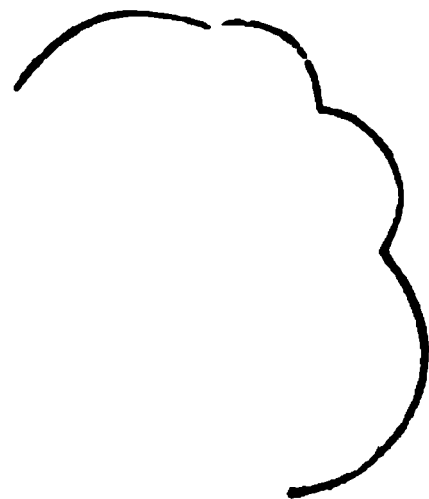


Fig. 15.—THE DOUBLE THREE.

few indeed are those who can start on a common three, and then edge the tail into an outside backwards.

When once the turn is learnt, it should be practised till there is no difficulty in cutting the figure S. After the S, practise a long serpentine line, and you may attain at length to the power of keeping up and even increasing speed by the management of the balance, as in the forward or backward roll upon both feet. By this device a good skater will wander about for minutes over the surface of the pond or river without putting down more than one foot during the whole of the time, and without bending the knee of the leg he is using.

Next to the S, and its sequel the serpentine, comes in a difficult but beautiful and favourite figure called the Q. This involves an edge and a three; for instance, start on the right outside forwards; when the circle is nearly completed,

Fig. 16.—THE HALF DOUBLE THREE.

change the edge suddenly to the right inside forwards, and soon afterwards shift again by making a simple three, thus arriving at the right outside backwards. It will be seen, by looking at the marks made on the ice, that the figure bears a pretty distinct resemblance to the letter. Q's may be made suddenly when

going at a high rate of speed, and the effect is electrical.

This is, in fact, by far the most "sensational" figure. It is also the most dangerous, as the least slip brings the performer to grief. Then there is the "reverse Q," in which the three comes first, and the edge is made in the tail of it—equally difficult but less effective.

Finally, "continuous Q's," by which the skater, always on the same foot, flits along over the ice in a succession of beautiful and mysterious evolutions, perfectly wonderful to the

eye of the looker-on. He who can do this well has little left to learn in the way of skating figures.

Among other well-known exercises, "loop" is effected by over-balancing the body, and recovering equilibrium by a quick turn of the foot (Fig. 19). Another is the "cross-cut," in which the balance is still further lost, and recovered by a backward stroke and then a three (Fig. 20), so that the second stroke of the three cuts backwards through the first stroke of all. Finally, most difficult of all, is the "rocking turn," or "broken-backed" three, in which, after the first two strokes of the last-mentioned figure have been made, the same edge is continued, so that the mark made on the ice resembles a shark's tooth, and the skater finds that he has "rocked" back from outside forwards to outside back, or from any forward or backward edge to the same edge in a contrary direction (Fig. 21).

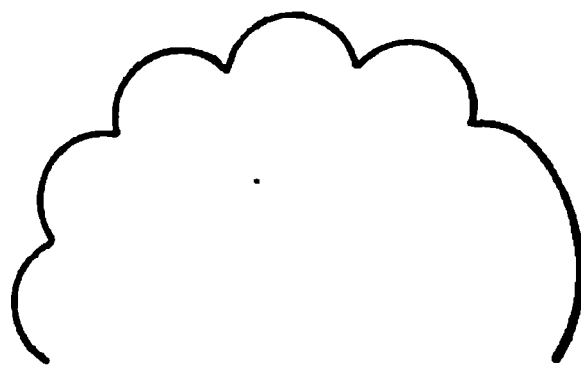


Fig. 17.—THE TRIPLE THREE.

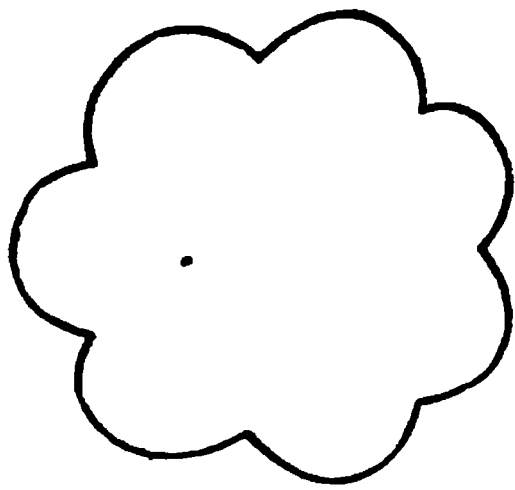


Fig. 18.—THE ROSE.

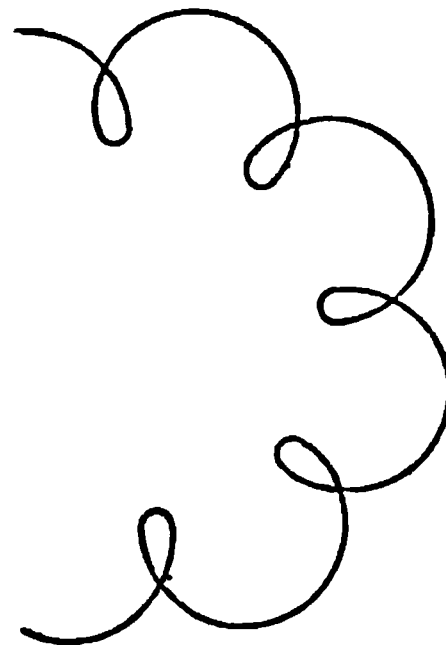


Fig. 19.—THE LOOP.

The skater who has advanced beyond the first few stages above described may now as soon as he chooses begin to join in some of the concerted figures which are the chief charm of our art. To begin them, let him stand face to face with another skater, and at a few yards' distance from him. The two then start forward, on the inside forwards, and at the moment of closely passing one another—each being on the left—they begin the stroke of a forward three on the right



Fig. 20.—THE CROSS CUT.

foot. This three is continued until the long tail of it comes round to the same point where the two skaters first passed one another. Let them complete the stroke till they almost touch one another, and then, putting down the left foot, start afresh on a second three on the left foot. By this movement, the poise of the body being altered, each is just enabled to clear the other, and pass on the right side of him; that is to say, the two left shoulders just escape touching one another, as the right

shoulders just escaped at the start. Of course, the second three on the left foot brings the two skaters round as before to meet one another, and ready to start on a third stroke.

After the "simple threes" come a series of figures, the name of which is sung out by the leader of the party as he comes into the centre just as the leader of a peal calls the changes on the bells. In all of them the skaters, whether they consist of only two partners, or of four, six, or even eight, stand facing one another in pairs, and come back after each evolution to pass one another as at first. When four pairs are skating the utmost accuracy in distance, pace, and time is required, and long practice only will insure anything like success.



Fig. 21.—THE ROCKING-TURN.

ROLLER-SKATING.

RINKS and Roller-skates (Fig.), which have been so popular within the last few years, require some notice at our hands. It is true that the first *furor* with which they were hailed has to a great extent cooled down; but the art of skating upon wheels remains, nevertheless, popular in many places, and will

always be worth the attention of those who are really fond of the exercise, whatever may be the season of the year or the state of the thermometer. The chief difference between roller-skating and the more legi-

ROLLER-SKATE.

itimate branch of the art is, that the strokes are made more laboriously, and of course, therefore, at a slower pace, than on the ice. There are a few figures, such as small loops and continuous eights, which it is almost if not quite impossible to do upon roller-skates, but these are very few; and for the most part what can be done on the ice can also be done nearly as accurately, though by means of greater exertion, on a dry rink. It was for some time supposed that lessons

learnt upon roller-skates were of little use for practice upon ice ; but the idea has been refuted by numerous examples ; and now it is no longer to be denied that those who wish to excel in either branch of the art may qualify themselves very effectually by practice in the other. The laws of balance are the same in each ; and we have seen that these laws are the most essential principle in skating. As the trial to the ankles is much less severe in roller-skating, beginners would do well in all cases to take their early lessons in this way before venturing upon the ice. The position of the feet and body, and, in a word, the attitude generally, should be attended to as carefully in rink-skating as elsewhere ; and it is consequently most important that a bad style should not be adopted in either case, but that the young skater should secure the services of a skilful instructor, and implicitly follow his advice.

SLIDING.

THE boy who has never in his early days enjoyed a good slide is never very likely to enjoy any manly out-door exercise. Sliding is a sort of natural introduction to skating, and by familiarising the beginner with the first laws of balance, and the strange feeling of motion without any corresponding action of the limbs, goes a long way towards teaching him the early rudiments of the more difficult art. The best place for a good slide is not, as many people seem to suppose, the middle of a large pond. This should rather be left for the amusement of skaters, whose sport is altogether spoilt by the presence of boots and shoes, especially if they are gravelly or muddy, as is generally the case. The slider requires a good long "run" upon dry land before he starts on the ice, and therefore by far the best place is a small pond such as is often seen in villages and farmyards. The slide should be made right across from one side to the other, and if the ice is good it may be sixty, eighty, or even a hundred feet long. The sliders, after arriving at the end of the slide, should run off on to the bank to a sufficient distance from the pond, and then, starting afresh, make another slide side by side with the other, but in a contrary direction. If the ground is covered with snow, the ice will not be spoilt by this running over it between each slide ; but should it be earthy or loose it must be covered with straw, or the slide will soon be dirtied and spoilt. At schools it would be easy in winter to make small artificial ponds fifty feet long and a few feet wide ; or a capital slide could be made by flooding an open racquet-court or a pavement, or even a smooth gravel or asphalt path. Snow-slides, made by polishing the surface of a thick snow layer, are very slippery, and may be used when the frost is only slight.

In sliding, the feet should be close together, the right foot in front and pointing forwards ; while the left is drawn up sideways at the back of the right heel. It is well, however, to practise all sorts of different positions, as by these means it is afterwards easier to do them with skates on. Thus the feet may be kept parallel, both pointing forward or sideways, or even backwards ; or the slider may practise starting with his face turned one way and leaving off with it turned the opposite way, the feet having gradually shifted their position on the journey. The most difficult and most useful practice of all, however, is that of turning both feet out till they are in the same straight line, the toes of the right foot pointing straight forward and those of the left pointing straight behind, while the heels are close together. This should be practised by all who intend to afterwards learn skating, for the position is much more easily attained by a young person than it can be when the joints are less flexible.

SWIMMING

SWIMMING is not only the most enjoyable, but the most really useful of all the many pastimes in which old and young alike indulge; and it is, indeed, time that boys and girls were taught to swim, as part of their ordinary education. Of all the athletic exercises it is the most easily learned; but in learning to swim instead of to float, we begin at the wrong end, and with the erroneous notion that swimming (instead of our own natural buoyancy) floats us in the water. Any person accustomed to the water will tell you that

he finds it very difficult to *dive* or *sink* (i.e., to strive against the natural buoyancy of the body) and not to float. Let one of our readers try to pick up a bright object from the bottom in five or six feet of water, and the very strong resistance he meets with will convince him that it is far easier to remain at the top than to go to the bottom. When a horse, dog, pig, or bullock gets out of its depth, it finds itself at

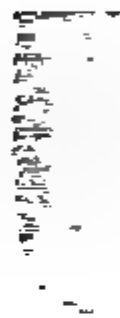


Fig. 1.—SWIMMING ON THE BREAST.

Fig. 1.—SWIMMING ON THE BREAST.

once lifted up, and floating with its head above water, and, having no fear of sinking, its anxiety to reach the shore prompts it to make the natural motion with its four limbs.

Man has not, like the quadruped, the advantage of guiding himself in the water in his ordinary position; and his uninstructed reason becomes a worse guide than the unerring instinct of the brute. Fear prompts him to raise his arms out of the water, and then they tend to sink him, whilst the necessary position of the animal's four limbs keeps them under water; thus, the efforts of the timorous to save themselves are the very cause of their drowning. Tossing with the arms above water, screaming with the mouth wide open, they get out of breath, water supplies the place of air, and they are choked or stifled—that is, drowned. But the time that it takes to frustrate their natural buoyancy proves the very thing they ignorantly doubted; for, if not lighter in themselves than water, they would have sunk like a stone. Nature has benevolently given us this buoyant principle of safety in common with the lower order of animals, and we perversely mar it by our ignorant terrors, and by absurdly fancying that the action of swimming, which is only moving

Fig. 2.—SWIMMING ON THE BREAST.

through the water, keeps us on the surface, and not our own natural buoyancy.

There are various modes of swimming. To begin with, there is the usual method; the upright or Italian; the dog-like; the hand-over-hand; on the back; on the side; with various limbs only; also under water or diving; and various fancy and ornamental methods of displaying one's power in the water.

The first rule in learning to swim is to gain *confidence*, and until one has that one cannot swim. As a rule one should never employ artificial means, such as corks, life preservers, or any such contrivances, as more can be gained by frequenting a tepid swimming bath, when within reach, where there are usually plenty of facilities for learning from qualified attendants, who are always at hand. We shall lead off our practical instructions with a consideration of swimming on the breast. (Figs. 1, 2.)

Having selected the most suitable place for the purpose, enter the water gradually, and when you have waded as far out as to let the water reach to your chest, turn towards the shore, draw your hands up to your chest, keeping the fingers close together, the thumbs pressing against the forefingers so as to form a sort of hollow scoop, which gives you a greater power of propulsion: the palms of the hands must be downwards. The lower part of the arm and elbow should be close to the body, as shown in Fig. 3; next stretch out the arms to the full extent just under the surface of the water, as in Fig. 4; turn the palms of the hands out and take a circular stroke until the arms are square with the shoulder, as in Fig. 5; then draw the hands back to the first position. These three movements in our new extension motions for learners of swimming should be repeated several times by numbers—*i.e.*, at the word *one*, draw your hands up to your chest, keeping the fingers close together, &c. (Fig. 3); at the word *two*, stretch your arms out to the full extent, keeping them just under the surface of the water (Fig. 4); at the word *three*, turn the palms of the hands out, and take a circular stroke until the arms are square with the shoulder (Fig. 5). When the learner has gone through these motions several times by word from the instructor, he should practise them himself, judging his own time, the speed of the movement being gradually increased until the three

Fig. 3.—SWIMMING ON THE BREAST: FIRST POSITION.

Fig. 4. SWIMMING ON THE BREAST: SECOND POSITION.

separate actions merge into one motion (Fig. 2), easily performed by the pupil.

The mouth must be kept carefully closed until the arms arrive again at the third position, shown in Fig. 5; then a full breath should be taken whilst the hands are returning to position number one (Fig. 3). This drawing of the breath is most essential, as all learners are very apt to draw their breath just at the moment they strike out, and to a certainty get a mouthful

of water, the effect of which, especially in the sea, is to make them very nervous and uncomfortable.

These strokes in swimming should be taken slowly and steadily, not exceeding a speed of twenty per minute. Having got so far, now is the time when learners require some amount of assistance; and one learner can help another, by following a few simple rules.

Have a belt made at a saddler's of the webbing generally used for horses' girths, of such a size as will go round the body easily; eyelet-holes must be punched into the ends instead of buckles, and about two yards of strong line the size of an ordinary little finger should be spliced at one end into one of the eyelet-holes, the other end being run through the other eyelet-hole at the other end of the belt.

The teacher should then place the belt round the pupil's waist with the rope in front of the chest (Fig. 6), and, holding the other end in his hand, must direct him to enter the water to his middle, and then strike out; the teacher walking backwards in his depth, or along the boards if in a bath, holding the end rather tight, so as to keep the learner in the most favourable

Fig. 5.—SWIMMING ON THE BREAST. THIRD POSITION.

position for swimming, and prevent his sinking. The pupil must keep his head well back on the shoulders, and the back hollowed, which tends to the inflation of the chest, and gives more buoyancy, and he must at the same time kick out his legs well. By repeating this exercise several times, he will get more confidence in the sustaining power of the water.

Sometimes the rope is passed over a pulley, at the end of a projecting beam, or crane, working on a centre, and giving way with the movements of the swimmer, or a strong wire is stretched across a large bath, and kept tight with screws; on this a pulley runs, and to it is attached the wire belonging to the belt, buckled round the learner's waist, the cord in this case being attached at the back, as in Fig. 7.

This contrivance (than which nothing can be more simple) will not only facilitate the acquirement of the art of swimming, but enable any one who may be a tolerably good swimmer to instruct any number of pupils in the art, by imitating the actions of the frog. Now that swimming has come to be considered a necessary part of every boy's education in those public schools that have any water within reach, this simple apparatus will prove the more useful, as it permits of the art being satisfactorily taught in smaller spaces of water. Repeat this practice several times, and on each occasion you will get more confidence in the great sustaining power of the water, but if you cannot get any assistance in the manner above described, let one of your feet occasionally touch the bottom.

Fig. 6.—SWIMMING BY MEANS OF A BELT.

The manner of kicking out the legs should be precisely similar to that of the frog—i.e., as you draw your arms and hands into the first position (Fig. 3) you

must at the same time draw up your feet and legs towards the body (Fig. 1), and kick them out again, at the same time as you strike out with the arms and hands. There is not so much importance attached to the stroke of the legs as to that of the arms, and for this reason, that as progress is made with the latter, the legs are sure to follow. A good swimmer very seldom swims on the breast since the side stroke in swimming has become so popular, although a previous knowledge of the breast stroke lends confidence when attempting the other. One can swim some distance on the breast by lifting the arms over the head and taking a circular stroke towards the side. Many can swim more than a hundred yards in this way as fast as some of our best swimmers on the side.

After learning to swim a few strokes, you should thoroughly acquire the power of floating, that being the easiest mode of supporting the body; indeed, when not able to swim, you can always learn to float in

salt water in a single lesson, simply by placing yourself on your back, throwing your chest well out of the water, and the head well back. (Fig. 8.)

With beginners, it is always very difficult to get them to keep their heads back; they generally lift their heads up, principally on account of the water entering their ears, the result being that the body is thrown into a position that entirely prevents them from floating, because it brings the mouth under water. The arms can be placed in any position, but it is preferable for them to be stretched right out, the palm of the hand just under the water. By this position the learner has a better mode of balancing himself, otherwise he is very liable to turn over.

After he has obtained sufficient confidence to be able to balance himself, he can place his arms in any position, either by the side, across the chest, or folded under the head; the latter position is best, as it throws the chest more forward, and naturally inflates the lungs. The lives of many persons have been saved by this simple plan; whilst thousands could have been saved had they merely remained quiet, with their heads thrown well back, instead of struggling and throwing their arms out of the water, which naturally causes the head to sink. Of course it is much easier to accomplish this in the sea than in fresh water. If in the latter, it would be better to just paddle the hands at your side a little, which will prevent your feet from sinking.

To acquire the power of floating well is to possess the key to all kinds of swimming on scientific principles; it is also very useful in cases of that terrible bane of

Fig. 8.—FLOATING.

the swimmer, the muscular contraction called the cramp, whatever part of the body which is thus attacked being rendered temporarily powerless. All are affected alike, and perhaps more good swimmers have been drowned by cramp than from all other causes. Strong men and good swimmers, when seized with the cramp, have been known to sink instantly, overcome with the sudden pain, and nothing but the very greatest presence of mind can save the victim.

Fig. 7.—LEARNING TO SWIM.

The legs and arms are the parts of the body that are most frequently assailed, by which means the difficulty of getting ashore is much increased, but there is no real danger so long as the swimmer preserves his presence of mind. *When accompanied by presence of mind, cramp is comparatively harmless*, but when accompanied with fear, it is almost certain to be followed by drowning.

If both legs are disabled, try to paddle ashore with the arms; if, on the other hand, the arms are seized, the sufferer should lie on his back, and get to land by the use of his legs; if unable to do either, he should throw himself on his back, and endeavour to float until succour reaches him. Under such circumstances, the following method has been recommended:—Turn on the back at once, kick out the leg in the air, without minding the pain, and rub the part attacked with one hand smartly, whilst the other is used in paddling towards the shore. It is very easy to give these directions, but they are most difficult to follow. Cramp appears to deprive the person attacked of all reason for the time, and to render him quite powerless from mingled pain and terror.

The causes of cramp are usually believed to be two: the first is from indigestion, for those in good health are seldom attacked by it; the second is the over-exertion of muscles that have been but little used, and when a very strong stroke with the legs or arms is given, it usually comes on; therefore, easy swimming is to be preferred to that with sudden strokes or jerks.

Balancing or perpendicular floating (Fig. 9) in the water is done by allowing the legs to sink gradually, so that the body may assume an upright position: the head must be thrown back, so that the chin may be on a level with the surface. The great requisite for the proper performance of perpendicular floating, is confidence; caution is always necessary; and the water should be quite still.

FIG. 9.—BALANCING.

Treading water is a mode of supporting the body without making any progress through the water, but of carrying the head well above the surface. By it, if a man is drowning, he may very possibly be saved, if two people take him by the arms, and keep his head above water till assistance arrives; but it must be borne in mind that it is a very dangerous experiment, unless the two rescuers seize the drowning person with very great determination, so as to prevent him from grappling them. The treading of the water can be done one leg at a time, or both together, but the latter is the better way, as a greater weight can be supported, when both legs raise the body at the same time. If one wishes to seize anything above the water level, such as the gunwale of a boat, or a rope, the body is raised by this plan of treading water with great vigour; also it is sometimes done with the hands alone, or with both hands and feet together.

Upright swimming, or the Italian method, is given by Bernardi as follows:—The pupil is supported in the upright posture in deep water, by means of a hand under the arms, which are stretched out horizontally under water. The head should never be allowed to sink, but the body may be left unsupported for a short time, if the pupil can be persuaded to remain quite quiet, which he will do if he has full confidence in his master.

If the legs are inclined to come forward or backward, or to rise on either side, a movement of the head in the same direction corrects the tendency; and this is instilled into the pupil, and practised accordingly.

When he can manage to maintain the perpendicular position by this mode of

balancing, the most difficult part of the process is accomplished. The next thing is to teach him to advance one leg, keeping the other back, and with the arms still horizontal; this is easily done, and the legs may be taught to be used as in walking. After this, the arms are practised in the manner peculiar to the plan which is first attempted, while the body is stationary, and is exactly the reverse of the use of the arms in the old style, each hand being thrust out nearly sideways, and then brought one after the other round in front of the chest, embracing, as it were, a body of water within its grasp.

When wishing to retreat, the body is inclined backwards, the arms are reversed, and the water is pushed from the body. The fastest rate of swimming in this fashion is considered to be probably not more than half the speed of the ordinary mode.

Fig. 10.—DOG-LIKE SWIMMING.

Dog-like swimming (Fig. 10) consists in simply following the same motions as the limbs of the dog make when progressing through the water. It is in all respects less useful than the usual mode, being so much slower, but as it affords rest through a different action of the muscles, it may be turned to very good account when the swimmer is much exhausted by a long swim.

The swimmer should lie on his chest, and move his hands and legs alternately, the right hand with the left foot, and the left hand with the right foot, one hand being thrust gently forward, with the palm flat and fingers close together; it is then brought back to the level of the breast, and the other used in the same way.

During the time that each hand is being so used, the foot and leg of the other side are drawn up, and then thrust backwards, outwards, and downwards with a good kick, but the learner must bear in mind the necessity of working the arms and legs in perfect unison.

The hand-over-hand (Fig. 11) mode of swimming is a very rapid one,



Fig. 11.—HAND-OVER-HAND SWIMMING.

and is frequently used when short distances have to be traversed, such as reaching a friend in the water who may be in danger, but it is too fatiguing to be used for any length of time, and is most commonly adopted for the sake of the rest obtained by the change of muscular action.

It seems to be the dog-like method carried to an extreme; each hand is successively drawn out of the water and thrown forward, with the arm

and shoulder to its full extent, with an action like a circular sweep. The last joints of the fingers should be a little bent, so as to make a small cavity, and enable the swimmer to hold the water as he draws his hands downwards towards the hips; the action of the legs is the same as in dog-like swimming. Whilst these motions have been gone through, the shoulder has become so far advanced as to throw the body on its side, just as the hand on that side reaches the water, and the opposite, by having come into position, is strongly thrust backwards.

The arms, as it were, revolve in an oval, but each hand must pause a moment at the hip, whilst the other is being thrust forward, and the stroke of the opposite leg is to be made at the same moment.

Swimming on the back, much the same as floating (Fig. 12), is at once the easiest, pleasantest, and most useful method of swimming; indeed, some learners can make very good progress in this way, even before they can swim on the breast.

Turn on the back, by forcing the leg and arm of one side against the water; next place the hand on the side of the body, just inside the hips, by the groin. Take care to keep the head well thrown back and immersed, all except the actual face; hollow the back a little, and at the same time expand the chest as much as possible; the elbows and knees are to be turned out, so as to be kept under the surface of the water, the head and body being in a perfectly composed state.

The legs are next to be drawn up and thrust back as in ordinary swimming, but the knees must not come out of the water; if the legs are not to be used, possibly owing to cramp, they must be kept in a horizontal position, with the toes and heels together. This method permits a great rate of speed being attained.

If a bather will only keep his lips tightly closed, and the body still, he will find that when he inflates the lungs by a deep inspiration, his face will rise almost entirely out of the water, and at each expiration, his face will sink as far as the eyebrows and lower lip, but not any lower, his nostrils being always free for the passage of the air required by the lungs.

Fig. 12.—SWIMMING ON THE BACK.

he experiences the immensely powerful buoyancy of the water, which would certainly prevent any one from drowning, whether he could swim or not, if he would only lie in the position of swimming on his back without moving his body or limbs, as he would be unable to sink, if he tried.

Another way of obtaining a position of total rest is to stretch out the arms as far as possible above the head, their weight acting as a counterpoise to that of the legs, the effect being that the toes are forced above the surface.

As before said, in the sea this plan of floating is very much easier than in fresh water, the face during expiration hardly ever sinking lower than the chin, whilst a good full inspiration will raise the whole face out of the water.

It is as well to acquire the power of swimming under water before learning the side stroke. This is practised by drawing as much air into the lungs as possible, and then with a spring forcing yourself under water and striking out in the same manner as on the surface, holding the breath. The learner will find great difficulty in keeping under water, the tendency of the body being to come to the surface, in spite of the effort made to keep beneath. The length of time one can remain under water is largely dependent on the formation of the chest, but the average time is about forty seconds. People can swim under water much faster than above.

After becoming an adept at swimming under water, you should learn to swim with your clothes on, and with your eyes open—they must be kept open in the act of diving or entering the water, as it is very difficult to open them after the head is once under water. In commencing to swim with your clothes on, begin at first with trousers and stockings on, then with your waistcoat, next the coat, &c., until you put on all your ordinary clothing.

By proceeding in this manner you will, by imperceptible degrees, become able to swim easily in all your clothes, and, in cases of necessity, be of infinite use in saving the lives of others when in danger of drowning. The least foreseen occasions of testing these powers may happen, wherefore you should be ready. Of course, a suit of old or cast-off clothes will do very well in learning this useful kind of swimming.

To make the Mill, Catherine Wheel, or Washing Tub, the swimmer must lie on his back with his knees up to his chin, then, whilst one hand is kept close to the body, and paddled with to sustain the swimmer, the other is moved with very powerful sweeps, so as to rotate the body on its centre at a rapid pace.

Speaking of the side-stroke (Fig. 13), Mr. F. Cavill says :—" Lay yourself on your side, and draw your hands up to your chest, as in the chest stroke, then the right hand must be thrust out to its full extent, the left hand only going about as far as the elbow of the right arm; next, the thumb should be tightened over the forefinger of the left hand, so as to form a cavity or scoop, which gives a much greater power over the water, a stroke with that hand should then be taken back to the thigh, using your full power with this stroke, the right hand taking a downward stroke, which act propels you along. The arms are then drawn up into the first position; at this movement you should inhale sufficient air to well fill your lungs, at the same time as your arms are being drawn up to the first position, draw your legs up to your body, and as the arms are struck out as before described, so also shoot out the legs, taking care not to let the feet come out of the water; or if so, the power of the leg-stroke will be quite lost."

Fig. 13.—THE SIDE-STROKE.

In commencing it is not advised that more than five or six strokes should be taken, then a few should be taken on the chest, and as you become more expert, you can increase the number of strokes, until the side swimming becomes the natural mode of progressing through the water, to the exclusion almost of any other style, unless you may happen to be in a sea-way, when the chest stroke will be found preferable, from its keeping the head and face so well raised out of the water and surf.

The principal feature in this side stroke is to keep your head in exactly the same position in relation to the body as when walking, and not to raise it up and down, as most inexperienced swimmers do, giving as a reason for so doing that it is to prevent the water from touching their faces or going into their mouths, instead of closing their mouths and pushing their heads through the water, the apex of the head being used as the cutwater in advance, to ease the progress of the body through the resisting water.

By lifting up the head the way or impetus is stopped, just as in a rowing or sailing boat any rolling or other motion other than advancing tends greatly to impede her progress; therefore, on exactly the same principle, when swimming, the body and head should not move, only the arms and legs, as propellers. Being on the side, and in the proper position for this stroke, it is impossible to see ahead, you should therefore steer yourself by an object behind you. By occasionally making a slight turn of the head, you can easily see whether you are

keeping in the right direction, or what is in your way. Care should be taken in turning the head, that it is not done suddenly, but gradually, as any sudden turn is sure to check your speed.

Having by thorough practice acquired a complete mastery over the side-stroke plan of swimming, the learner may proceed to a modified, but what by some is thought to be a more powerful mode of swimming, called in some cases the "Indian stroke," because generally used by the North American Indians; by others it is called "thrusting" (Fig. 14), the latter used when the arm is thrust forward, the former when it swings; the action is like an almost continuous stroke, as in a screw propeller, the position is just the same as in the side-stroke, the only difference being in the stroke of the arm.

In the "Indian stroke," the left hand commences from the thigh, with the palm of the hand up, and concave; the hand is then drawn out of the water, very steadily, to the full extent of the arm, ahead of you, replacing the hand in the water, palm downwards, where the full power of the stroke is given back to the thigh; then the right hand is wound in a circular stroke from the right side to the left chest, and as the left hand rises out of the water, draw the right hand

back to the right side, ready to strike out. These strokes are made simultaneously, the legs working with the arms; thus a continuous stroke is obtained.

This is rather a showy style of swimming, but some people don't care much for it. The swimmer is certainly propelled very rapidly for a while, but it requires such a great amount of exertion, that he tires ere he has gone any very great distance, or practised it for long.

Fig. 14.—THRUSTING.

Another kind of fancy swimming is to turn **Head-over-Heels**. The body is curved or bent at the hips, the hands are straightened along the sides, and used as if throwing the water over the back. In this way you drive the head under, at the same time using the feet as in ordinary swimming, the result being that you make a complete somersault, or turn head-over-heels.

Heels-over-Head is done by the swimmer lying on his back, drawing his legs up with the knees straight, then paddling very sharply with his hands, and bringing his feet over his head, when, the body being overbalanced, a complete revolution is effected.

Sometimes two swimmers join in making a **Double Wheel**. This is done by interlacing their feet and knees, and then, whilst keeping their bodies apart, they each use their right hands with great power, and their left hands as sustaining paddles, thus making revolutions in a large circle.

The **Float** is the name given to a very useful method which should be practised more frequently than it is. It is done as follows:—When one swimmer lies on his back with feet stretched out, another takes him by the feet and propels him forward—a most useful plan to adopt in cases of cramp or danger.

Another mode, called **The Plank**, varies only a little from the last, and is done by two swimmers; one places himself flat on his back with feet widely apart, hands close to his body and the head well up, his companion takes hold just above his ankles, and pulls at them, and at the same time impels himself, and, if correctly done, one swimmer will quickly pass over the other.

Leap-Frog is another amusing way of swimming, and is practised by one swimmer treading water, whilst his companion swims up to him, then laying

both hands on his head, he gives a shove downwards, and whilst his companion sinks he passes on, and then treading water himself offers a "back" in his turn, just as it had been given him before.

Diving, or taking a header, should be practised by all learners of swimming; a graceful and proper manner of entering the water being cultivated assiduously, it is just as easy to learn this accomplishment gracefully as clumsily, common care being all that is necessary from the first. Headers may be taken from a boat, from the bank with a good run, or from any platform or other height, such as a spring-board, or off a ladder step by step; but jumping off any height should not be attempted till after great practice at the jumps off boats or other slight elevations. However, bear in mind that when diving at a spot where the depth of water is not known to you, it is very necessary for you to ascertain that the water is deep enough for diving purposes. Death has, it should be stated, in many cases resulted from accidents that have happened to persons unknowingly diving in too shallow water.

Fig. 15.—DIVING.

Beginners are generally much alarmed when first told to jump into the water, fancying instinctively that their heads will come in contact with something; therefore, when trying the "header" they come flat on the water with a regular flop, and make a splash, sometimes hurting themselves very much, the act of striking the water having almost as stinging an effect as a smart stroke from a schoolboy's birch. The learner may go to the river bank at a spot where it is not too shallow, and then, stooping down until he is nearly double (Fig. 15), he must place his hands together over his head, lean over till they nearly touch the surface, and so quietly glide, rather than fall, into the water (Fig. 16). He will not at first acquire the proper position, but after a while he will take his header without any hesitation. He must practice headers over and over again, taking care each time to increase the height from which he jumps. After becoming a proficient in this exercise, he should practice taking short runs, and leap head first into the water from the place where he took his first lessons in plunging, as he will have

Fig. 16.—A HEADER.

much more confidence in a place he is accustomed to. Leaping-boards are very good things to practise from.

In taking headers properly, raise the arms over the head several times, so as to expand the lungs; then the hands must be joined over the head, fingers and thumbs together, the back kept hollow, and the body stiff, straight, and still, the legs being stretched out firmly, the feet pressed together, and the toes pointing in a line with the body and legs. Enter the water like an arrow (Fig. 16), without

making any splash, this being the test of a good "header;" gliding down into deep water as far as your impetus will carry you, at about the angle forty-five: there should not be a bubble to mark the spot at which you entered. Care must be taken, however, to enter the water head first, or you may fall on your chest or stomach, injuring yourself very much, or, at the least, knocking the breath out of your body, and running the risk, especially if alone, of being drowned before recovering yourself.

If the plunge is taken properly, the "shoot," as it is termed, will be from twelve to fifteen yards. If you wish to swim near the bottom, place your hands back to back, and take a downward stroke till you reach the bottom, and then practise swimming under water as long as you can—this being a very important part of a good swimmer's education. By entering the water with the eyes open, with the view to fetch some object from the bottom, you will soon become a

thoroughly good diver without noticing the progress you are making. A lump of chalk, a small plate, or piece of tin, are very good things to throw in and then search for till you find them, commencing a few feet from you, and then increasing the distance gradually till the object is some twenty yards off.

The main points to be observed in diving are to *keep the body, arms, and legs perfectly stiff, and all in the same right line.*

Those who will follow this rule will be able to leap from considerable heights without danger. The hands placed together over the head form a kind of wedge, which cuts its way into the water and opens a passage into which the body enters. The diver must bend his head over the chest in such a way that even the slight shock which is sure to ensue on reaching the water affects only the crown of the head, which is the very part best able to bear it.

Fig. 17.—DIVING FEET FIRST.

The exact position can best be learned by watching good swimmers taking headers. Their bodies are quite stiff, and on reaching the water there is not the least alteration of attitude, the body shooting through the water like a fish, and passing through a wonderful space by the impetus of the spring. Some teachers are advocates for jumping into the water from a height *feet first*, the legs and feet being kept close together with the arms against the sides, entering the water quite perpendicularly, as shown in Fig. 17.

One recommendation of this way of entering the water is that there is no fear of accident with it, and though it is not so graceful as the header, yet in jumping from a height it is just as effective, and far safer in jumping into strange places, where, from not knowing the depth of the water or the nature of the bottom, an accident might arise from going in head first, by which many excellent swimmers have been killed.

In jumping out of a boat, the best way is to go to the stern and leap over, as there is much more resistance to the feet than is obtained by leaping over the side; and in getting into the boat again always come to the stern, never the side. In approaching the boat, swim with the feet high, grasp the transom with both hands, and kick the feet on the surface of the water, so as to keep them up. If you do not mind this, the legs will be sucked under the boat.

With a vigorous kick of the feet, and spring and pull of the hands combined, you rise up out of the water, and find yourself with your breast lying over the

stern, so that you are able to crawl easily into the boat, but there is great exertion required to perform this exercise properly, and almost every one gets many hard knocks on the shins, however careful he may be. For these reasons a short broad ladder, with four or five steps, or a roller across the transom to be pulled in over, forms a far more pleasant means of regaining the boat and your clothes than climbing over the stern at the risk of hurting your skin and bones.

INSTRUCTIONS FOR SAVING DROWNING PERSONS.

1. When you approach a person drowning in the water, assure him, with a loud and firm voice, that he is safe.
2. Before jumping in to save him, divest yourself as far and as quickly as you possibly can of all clothes; tear them off if necessary, but if there is not time, loosen, at all events, the foot of your drawers, if they are tied, as, if you do not do so, they fill with water and drag you.
3. On swimming to a person in the sea, if he be struggling, do not seize him then, but keep off for a few seconds, till he gets quiet, which will be after he gets a few mouthfuls of water; for it is sheer madness to take hold of a man when he is struggling in the water, and if you do you run a great risk.
4. Then get close to him, and take fast hold of the hair of his head, turn him as quickly as possible on to his back, give him a sudden pull, and this will cause him to float; then throw yourself on your back also, and swim for the shore, both hands having hold of his hair, you on your back, and he on his also, and of course his back to your breast. In this way you will get sooner and safer to the shore than by any other means. One great advantage of this method is that it enables you to keep your head up, and also to hold up the head of the person you are trying to save. It is of primary importance that you take fast hold of the hair, and throw both the person and yourself on your backs. After many experiments, this is found to be vastly preferable to all other methods. You can in this manner float nearly as long as you please, or until a boat or other help can be obtained.
5. It is at all events doubtful whether there is such a thing as a *death-grasp*—at least, it must be unusual, for many who have witnessed several cases of drowning have never seen it. As soon as a drowning man begins to get feeble, and to lose his recollection, he gradually slackens his hold, till he quits it altogether. No apprehension need therefore be felt on this score when attempting to rescue a drowning person.
6. After a person has sunk to the bottom, if the water be smooth, the exact position where the body is may be known by the air-bubbles which will occasionally rise to the surface, allowance being of course made for the motion of the water, if in a tide-way or stream, which will have carried the bubbles out of a perpendicular course in rising to the surface. A body may be often regained from the bottom before too late for recovery, by diving for it in the direction indicated by these bubbles.
7. On rescuing a person by diving to the bottom, the hair of the head should be seized by one hand only, and the other used, in conjunction with the feet, in raising yourself and the drowning person to the surface.
8. If in the sea, it may sometimes be a great error to try and get to land. If there be a strong "outsetting" tide, and you are swimming by yourself, or have hold of a person who cannot swim, then get on to your back, and float till help comes. Many a man exhausts himself by stemming the billows from the shore on a back-going tide, and sinks in the effort, whereas, if he had floated, a boat or other aid might have been obtained.
9. These instructions apply alike to all circumstances, whether the roughest sea or smooth water.
10. In case you are roughly seized by a drowning man when attempting his rescue, the best thing to do is to dive with him at once, as this is almost sure to make him let you go, as he won't like the sensation of going to the bottom; but, in the event of his sticking to you, as a last resort, a smart rap or two on his head will make him quiet, and enable you to save him in safety.

In training for swimming races, the chief requisite is good wind. This is particularly necessary for swimmers, as on plunging into cold water the exercise of swimming produces an oppression on the chest which, if you are not in good condition, you cannot get rid of without stopping and treading water; this attack feels like a lump of lead at the chest, and has been the cause of many failing to gain a race they were otherwise quite capable of winning.

The under-mentioned instructions will be found of great assistance to those who may wish to go through a course of training, though those only of thoroughly good constitutions should enter for races. The stomach should be kept in good order, and, if not so, should be treated to a course of mild aperients, while those of bilious temperament should adopt a more vigorous treatment. Get up before six o'clock in the morning, eat a small dry biscuit, and drink a small cup of cold beef tea; then start for a smart walk for a short distance, to settle the biscuit and beef tea; next commence a running exercise for several miles, starting with a short distance. After about two hours of this exercise, go to a swimming-bath or river, taking the greatest care that no chill is taken, nor that you get cool before entering the water, as the bath is intended more as a refresher than a swimming exercise, and remain in the water for only two or three minutes; on coming out, be well rubbed with a coarse towel. By this time you will be in good condition to enjoy your breakfast. This should consist of cold tea, or barley water, without sugar or milk, a small chop without the fat, or a steak underdone, and whole-meal or ordinary brown bread.

After breakfast, take a quiet walk for two or three hours; then commence the swimming exercise. The distance in the practice should be in proportion to the distance to be swum in the race; for instance, if you are going to swim a thousand yards, you should commence by swimming a quarter of that distance, and then increase it each morning for a week; by that time you will have completed the thousand yards. As this course of training would last for three weeks or a month, it is best, after the first week, to swim the distance every other day for the second week, and half the distance on each intervening day. During the last week the whole course should be done every day, except the day before the race, which should be kept as a day of rest, not of absolute cessation from all exercise, but moderately quiet.

The dinner should be similar to the breakfast; beef tea instead of cold tea. All vegetables should be avoided, with the one exception of potatoes, and these should be taken only in small quantities. Pork, veal, ham, and any young meats should never be taken; also oysters, eggs, cheese, broths, soups, pies and puddings, seasonings and fruits, must be avoided. After dinner, half an hour's sleep should be taken; and then the remainder of the afternoon should be spent in some light exercise, as rowing or gymnastics, or, where obtainable, horse exercise. After tea, another long walk should be taken, or a steady run; in running, if you suffer from any pain, the part affected must be well rubbed.

If the person under regimen is easily blown, or his spirits are low, or if he shows any sign of physical derangement, the system of training must be changed, and the change persevered in till all the symptoms disappear.

In many cases the joints become stiff from over-exertion in some of the exercises necessary to proper training, or, may-be, from some local weakness; this may be treated by rubbing the part affected with a liniment of hartshorn and oil, or any other similar preparation.

When the course of training is completed, and the person is in good condition, the skin should be smooth, well-coloured, and elastic, the flesh firm, and the spirits good. There should be a general feeling of lightness and activity. A good test of proper condition is to run about a mile at top speed; if this can be done without getting blown at all, and without producing a pain in the side, the training has been fairly successful. Those engaged in business, who cannot devote their time to a strict course of training, should set apart the morning for the walking and running exercises, and the evening for swimming, taking care to retire to bed not later than nine o'clock. Business will not in any way prevent a course of diet according to the specified regulations.

OYOLING.

TIME was when this article would have been headed "Bicycling," but, in the rapid growth of the most modern and most popular of all manly sports, the improvement of the bicycle extended itself to the ancient velocipede, which assumed a new shape in the form of a spider-wheeled, rubber-tired, easy-running tricycle which, in its details, has kept pace with the two-wheeler, and is now well worthy in every way to take its stand alongside the bicycle. Hence we must employ "Cycling" as our title. It is scarcely necessary at the present time to call attention to the wonderful manner in which cycling has rushed to the front; for although the first bicycle came to England in 1867, bicycling did not really commence until 1869, and even then the machine was one that would not be ridden nowadays by the humblest follower of the sport.

THE BONESHAKER OF 1869.

It was a fearful thing when one thinks of it. In outward shape it somewhat resembled the Safety of to-day, but in actual mechanism it was entirely different. There were wooden wheels of equal size—thirty-six inches—joined together by a solid iron backbone, and the cranks were fitted to the front wheel. The smallness of this wheel necessitated the rider sitting far back on the spring in a most ungainly position, and, in the absence of india-rubber tires, the general rattle and the vibration of the iron tires on the road well earned for the machine the sobriquet of "boneshaker." But even this machine had not been built in a day.

THE DANDY-HORSE OF 1818.

We must go back to the year 1818 to get at the first idea of a velocipede. A coach-builder of Long Acre in London, named Johnson, then produced a wooden affair known as a "hobby-horse," which ran on two wheels and was steered by a forward handle, but the propulsion of which was secured by the rider's toes, which just touched the ground; and on level roads and down hill the hobby-horse was not to be despised.

THE FIRST BICYCLE, 1862.

The hobby-horse died out, however, and it was not until 1862 that it was revived in France in the shape of the first bicycle in which the propulsive power was obtained by a couple of cranks acting in a rotatory way on an axle, the cranks being pressed by the rider's feet. The progress of the bicycle, moreover, differs from that of another machine of speed, to wit, the locomotive, in this wise: the splendid locomotives of to-day are in principle the same as George Stephenson's "Rocket" now to be seen in the Patents Museum at South Kensington, namely, they both have direct action, and the progress has been in details, whereas the popular bicycle of to-day—the Safety—does not, as did the boneshaker and as does now the "Ordinary," or high bicycle, drive by direct action on the front wheel. The Safety, the history of which follows, drives from the rear wheel, and the front wheel is only used for steering and balancing.

COVENTRY AND THE RUBBER TIRE.

Coventry, the home of the ribbon trade, was in dire straits by reason of the rapid decay of that trade, and some of her wealthier citizens founded a special company to give a new industry to their city. That company first made sewing-machines, then boneshakers, and, like all English manufacturers striving after excellence, eventually introduced the rubber tire and the "spider," or suspended wheel in which thin wires took the place of thick, clumsy wooden spokes. A word about this wheel. The pulling or tension strain of thin wire is great, very great indeed when compared to its power of resisting being doubled up. It would have been impossible to use wire for spokes except for the invention of

the suspension wheel. In this wheel the strain on the spokes is a pulling not a doubling up one; hence its name. Not only was the bicycle improved in these respects, but the size of the front wheel was largely increased, namely, by 12 inches, and the rear wheel was reduced in like proportion. Thus we had a 43-inch front wheel and a 24-inch back wheel, instead of two 36-inch wheels. which alteration got rid to a great extent of the awkward-looking position of the rider, and gave him more power, while, at the same time, nothing was added to the weight, as the rear wheel was reduced in size. This was in 1872, and it was then thought that perfection had been reached, so great was the ease of running of the new bicycle as compared with the "boneshaker."

THE PERFECT MACHINES OF 1872 AND 1891.

As a matter of fact everything in the "perfect machine" of 1872 has now been superseded for the better. Leaving out the Safety altogether, and adhering for comparison's sake to the high or Ordinary bicycle, we find that the 48-inch front wheel has gone up in some instances to 58 inches and 60 inches, and the 24-inch rear wheel has dropped to 12. The old flat steel spring, working on the backbone, on which the saddle used to be screwed, has given place to a saddle and spring in one, the spring being of round steel wire; the plain bearings have given place to ball bearings, *i.e.*, the axle revolves in a circular case full of hard steel pellets each about the size of a pea, so that friction, and consequently labour, is lessened. The coned pedals have also been supplanted by ball bearing pedals, and the socket head, which used occasionally to stick if not kept well oiled, now rests on a necklet of balls. The footrests on the high bicycles have been discarded, and "legs over the handles" is voted at once the most convenient and safest mode of travelling when the feet are off the pedals. The brake has left the rear wheel and now is applied to the front, and the spokes instead of being direct, or straight between the hub and the rim, are interlaced on the Tangent principle, that is, they follow as nearly as possible the actual line of pull of the suspension wheel. Solid iron rims have given place to hollow rims; handles have been widened; india-rubber covers the pedals instead of plain wood, and last, but not least, the once triumphant solid rubber tire, the thing in fact that made modern cycling possible, received its quietus at the hands of the cushion, and more particularly the pneumatic or air tire.

PNEUMATIC AND CUSHION TIRES.

It may perhaps be convenient to describe these tires now. The cushion is a tire about $1\frac{1}{4}$ inch in diameter, as compared with a $\frac{3}{4}$ -inch solid tire; the "cushion" consisting in the tire having a hollow circular cut right down the centre, which not only lessens weight and thus allows of a larger surface of rubber acting between the iron rim and the road, but also, because of its hollowness, gives more elasticity than a solid tire. The hollow of the cushion tire, however, has in it only air at atmospheric pressure. The pneumatic tire is a different affair altogether. It is made in three distinct pieces, although to the eye it appears when on the machine to be only in one piece. It is made in this way. There is an inner tube of very good pure rubber, less than one-eighth of an inch thick. This is the "blower" or air tube. Were it blown up, however, without any outer protection, it would extend to enormous dimensions, and probably take fantastic shapes at the weak points of the rubber. It is, therefore, before being blown out, inserted in a canvas tube, which keeps it when blown up in an equal and symmetrical shape. Canvas, however, cannot run against a gritty road. It would be cut through in three miles; therefore it, in its turn, is placed in a covering of india-rubber of suitable thickness, and this outer covering is what the eye alone sees and the road alone touches. Were these three substances solutioned together, the united wall would be so stiff that resilience, *i.e.*,

elasticity, would be lessened, and it is to its resilience that the pneumatic tire owes its wonderful power, a power not only of lessening vibration, which is considerable, but of adding to the speed of a rider; for as the air, compressed by the weight of the rider, is released on the passage forward of the wheel, it serves as an impetus to urge the bicycle or tricycle forward. This one invention has after several years of rubber tires revolutionised the entire trade of cycle manufacture. The pneumatic has its faults; these are its comparative costliness—it adds £2 per wheel to the outlay—and its habit of bursting at inconvenient times and places, either by an accidental or a malicious puncture.

THE SAFETY BICYCLES OF 1891.

Having traced the Ordinary bicycle up to its present position it is desirable to take a like course with regard to that bicycle—the Safety—which has almost supplanted it, and which has, to a very large degree, lessened the number of tricycles which would otherwise have existed. The greatest difficulty in connection with ordinary bicycle riding is the mounting, and this point is practically rendered easy in the dwarf or Safety bicycle. It was in the year 1885, at the Stanley Show held on the Victoria Embankment in London, that the Rover Safety or rear-driving bicycle was first exhibited. Cycle-making seemed to have gone back years. The tall wheel was gone, and in place of it were two small 30-inch wheels, smaller than those of the early boneshaker. Men laughed and thought it an absurd affair. When they had tried it the steering was found more difficult than that of the Ordinary bicycle, because the foot could play no part in the guiding of the machine, the cranks not acting directly on the front wheel axle but on a bearing placed between the two wheels, the entire driving power being transmitted thence to the rear wheel by means of a chain running on “toothed” wheels. As riders, however, became used to steering with the arms alone and the wonderful speed of the Safety developed itself, it became a marked favourite and has never since receded. A strong but short-legged youngster who could only span a 50-inch Ordinary at outside, found that he could ride a Safety geared up to 60 inches, and naturally cover more ground with little or no more exertion. Since then all the short-legged riders, all the timid riders, all the clumsy riders, all the careful riders, and all the riders who were losing their youthful elasticity, and who would otherwise sooner or later have come to a tricycle, deserted their Ordinaries for the modern Safety which stands at the head of the cycles of the day.

THE TRICYCLE OF 1891.

Having said so much as regards bicycles, it may be desirable, before proceeding to deal with the questions of learning, riding, racing, &c., to say just a few words about the tricycle. The modern tricycle is the outcome of the desire of those past the flush of youth to partake of the pleasures of cycling. The tricycle had no “boneshaker” stage. There were four-wheeled wooden velocipedes running, and extensively used, in the early fifties at Cambridge and elsewhere, but it was not until the bicycle had passed some years of its suspension wheel and rubber-tired era that the tricycle came upon the scene. It was a clumsy affair even then, although fitted with spider wheels and rubber tires. The driving wheels were large and consequently heavy, and the steering wheel was small and ineffective by reason of a bath-chair handle being fitted as a steerer, which, although safe enough for the pace of a bath-chair, was not delicate enough in touch to steer steadily a tricycle when pace began to increase. This was, however, improved by the substitution of a rod and cogged racket steering with spade handles at the side. Finally the bicycle handle was reached, and with it the size of the driving wheels came down in diameter and that of the front wheel went up; a necessity seeing that from it comes most of the vibration. The rear-

steering tricycle had its short run, but the tricycle of the day is a machine with practically three equal-sized wheels, say 30 inches, one of which is in front as a steerer and the other two are drivers coupled together by balance gear, *i.e.*, by a gear so arranged by bevelled cog-wheels that it locks solid when the machine is driving straight ahead and begins to revolve slightly the moment it diverges from the straight, thus driving on one wheel only and admitting of the steering being carried out. The tricycle is the machine of one's very early years, when it takes the form of a tricycle-horse—much harder to drive, by the way, than a regular tricycle—and also of one's later days, when the nerve-power for balancing begins to fail. "Bicycles for boys" is a truthful alliteration.

WHEN TO LEARN CYCLING.

The rider who begins cycling when young has, as in all athletic pursuits, the pull over those who start later in life. He has the elasticity of frame to learn without unduly straining himself, and he acquires such proficiency that cycling becomes part of his ordinary motion. With the exception of horse- and pony-riding, we can recall at the moment no one pastime which appeals equally to the old and young except cycling. Many of the pastimes of youth, such as marbles, leap-frog, &c., the boy, as he grows to manhood, ceases to care for, and on the other hand a youth has to grow up before he takes kindly to shooting and such like sports. But in cycling, extremes of age meet and both derive in their separate ways pleasure and physical benefit from the wheel. A boy only thinks of whether he likes a pastime, and never whether it does him any good, physically speaking.

CYCLING MEDICALLY VIEWED.

It must therefore be a great pleasure to parents to know that in the indulgence of cycling their children, male or female, are not only getting amusement but also gaining health. It was unfortunate for cycling that the hobby-horse, which placed a man in the worst possible position, namely, straining his leg whilst it was extended to its utmost, should at the outset have prejudiced the medical profession against cycling. Now, however, almost without exception, the faculty are practically unanimous in its praise; many well-known members who could be named being absolute enthusiasts. The advantages of cycling are now no longer a moot point, and, in the words of Dr. Richardson, every person "can ride with benefit to himself, except those suffering from consumption and heart disease, or who are decidedly prone to apoplexy." So long as a watchful eye is kept on the young rider to see that he does not overdo it and that he suffers no inconvenience from his saddle, there is no cause for anxiety. Apropos of this it should be borne in mind that the fibre which binds a boy together at the seat is not so tough as that in an adult, but it only needs care and intelligent forethought in the adjustment of the saddle to secure perfect immunity from damage.

HOW TO LEARN.

There are not many regular schools for teaching nowadays, but most vendors of machines will make arrangements for a purchaser to be taught by one of their men. Failing this, however, it only requires the assistance of a companion (two for choice) a little stronger than the learner, to enable one novice to easily teach another. The best preliminary step is for the learner to wheel his bicycle and letting it fall gently towards him, to feel it spring upright again as he turns the front wheel *towards* him, *i.e.*, the same way the machine is falling. He will then realise better than he could whilst in the saddle how a bicycle rights itself. His wits are clearer when on *terra firma*. Having thus gained an idea of how a bicycle is kept on end, the learner, with a friend on each side of him, can seat himself in the saddle, seeing first that it is at a proper height. The beginning and end of ease in cycling depend on this, and the

gauge is as follows: when the rider is seated on the saddle, the centre of the bottom of his foot should just be able to touch the pedal at its lowest point. In pedalling, however, he uses the ball of his foot, i.e., midway between the centre and the toe ends, and this enables him to use his ankles as well as his thrust of leg; but ankle action comes later—not in the learner's stage. Every modern machine is made with handle-bars so wide that no contraction of the chest can occur in holding them; but riders should insist on the handles being capable of being raised so high as to obviate the necessity of craning forward. When spurting, as later on in his career the novice will, he will crane forward, but he should be able to avoid being obliged to do so at other times. Many modern machines are faulty in this respect—handles too low—as regards comfort, appearance, and health; but it only requires a buyer to insist on a longer tube for adjustment of his handles to be comfortable. Learning to ride is the easiest part of early cycling. Mounting is the most difficult, and next comes dismounting. But to deal first with learning. With a professional teacher inside a room the rider will be always on the turn, which although increasing his earlier difficulties, makes him a better rider when left alone than if he had learnt on a straightaway course. If he learns in the street let it be in a secluded one; a *coul de sac* for choice and on a very slight slope. Here with a friend or friends to hold him up, he will soon acquire the balance, and if he has a fall or two it will give him confidence by letting him know the worst that can happen. It is useless going on learning when fatigue sets in; either rest awhile or stop till next day. An hour at a time when learning is enough for anyone. Having acquired the balance, the next thing is to dismount.

DISMOUNTING.

For a light weight, the dismount from the pedal is the best, and is effected by putting the weight on the left foot on the pedal as it rises, and swinging the right leg sharply and boldly back so as to clear the hind wheel; this refers to both Ordinaries and Safeties. Heavy weights will find the step the best means of dismount. Indeed, to stand on the step and steer the machine is at once a good way of learning the balance and how to mount and dismount. To dismount from the step, search back with the left foot, and having hit on the step, raise the weight of the body on the handles and swing the right leg clear of the back wheel as in the pedal dismount. The backbone dismount applies only to high bicycles. It is performed by placing the left foot on the backbone, and having thus gained a slight foothold, swinging the right leg back as in other dismounts. Dismounting by swinging the right leg over the handle-bar is an acrobatic feat, and not one for a learner. There is a form of dismount which has been, or rather was, advocated in the days of the Ordinary bicycle, namely, vaulting off backwards. This is a form of dismount to be avoided, or exercised only with the greatest care. In the first place, to vault at all is to court rupture: it is one of its most frequent causes; and secondly, to vault off backwards, having forgotten perchance that your rear wheel is higher than usual, is to court a worse disaster than rupture. Therefore, avoid the vaulting dismount.

MOUNTING.

To mount, put the rear wheel between the legs and take hold of each handle, place the left foot on the step and push on the ground with the right foot until the machine has sufficient motion to enable the saddle to be reached and the pedals seized by the feet before the pace ceases. In the old days of high machines only, this operation required great faith; but it is comparatively easily accomplished now. There are "trick performers'" ways—amateurs and professionals—of mounting and dismounting, but they do not appeal to the ordinary learner. Frenchmen seem to have the happy knack of easily acquiring the pedal mount,

but this is difficult and strains the pedal somewhat. It is, however, very effective to look at. The mounter runs the machine quietly along for a few strides, then catching his left foot on the left pedal just as it is rising, lets it raise him into the saddle. Frequently the machine stops, and the learner unless very quick never reaches the saddle.

CARE ON THE ROAD.

The rider's cares are not over when he has learnt to ride, to mount, and to dismount. He then wants to acquire the "coachmanship" of the cycle. He requires to know the rule of the road amongst traffic and adhere to it; much can be learnt by a ride on the box seat of an omnibus in this respect. Then he needs to experience that, although very wet roads are not dangerous, stone paving and wood paving and asphalt, and even occasionally macadam (but never gravel), are extremely difficult to traverse on a bicycle if they are greasy, namely, half dry or newly watered by a hydrostatic van, because the wheels slip sideways from under their rider. He requires to learn that, although he cannot go too fast in a straight line, he must ease up at a corner, otherwise a bicycle will not come round at all and a tricycle will capsize. He must learn to lean *inwards* at corners. He needs to know that only very skilful riders can descend hills without brakes, and that even they would be more comfortable with brakes, as back-pedalling downhill is almost as hard work as pedalling uphill. He must acquire the knowledge that to ride to a standstill uphill, frequently means an inability to dismount except by falling off; and also learn to work up hill by his legs only, leaving "pulling" at the handles for an emergency. When he has learnt these he will be a fairly accomplished rider.

HOW TO GET A MACHINE.

There are various ways. The Rothschilds of life buy them at list price at the various depôts as they strike their fancy; wise men with ready cash demand and mostly get discount for payment on the spot; those with limited but sure means buy of first class-firms on the hire system, and pay by instalments at so much per month. As a rule, unless its history and its former owner be known, a secondhand machine should be avoided. A machine with no maker's name on it should not even be looked at by the novice. Only a machine bearing the name of a well-known firm should be accepted on trust. There are firms, makers of new machines, who apparently do a trade outside what is known as the wheel world, that is away from the circles frequented by the men who know "what is what." No firm that is not known in the wheel world should be entrusted with an order. It is very easy to drop a postcard to any of the cycling papers, and ask the question, "Can you recommend So-and-so's machines?" The answer, the meaning of which is known only to two persons, will appear in the "Answers to Correspondents" column, and the purchaser will be reassured or the reverse. There is no such thing as a best cycle. The machines made by the large first-class firms at Coventry, Nottingham, Birmingham, London, Manchester, and other places differ in detail, but in quality they are practically the same; the selection of one before another is a mere matter of individual taste. The boy or man who rushes in to buy a machine without asking advice when such can be obtained at the expenditure of a halfpenny postcard is unwise. The same remarks apply to novices who desire to join a club, go on a tour, or indeed take any cycling action whatever.

ACCESSORIES REQUIRED.

The cyclist of to-day is bound by certain laws. He must not ride on the footpath, or at such a pace or in such a way as to endanger the public. He must carry a bell or whistle and sound it before overtaking or meeting any

vehicle, equestrian, or pedestrian in the roadway. One hour after sunset he must light his lamp and keep it lit till one hour before sunrise, under a penalty of 40s. For his own safety and courtesy's sake combined, he will dismount on meeting a very restive horse. This is what he should do, but he is bound to carry a lamp and a bell. He should always carry a valise with oil-can (filled), spanner, and screwdriver. He can for luncheon purposes now buy a special valise for the handle bar, and he can also choose from a rare assortment of bags of all kinds in which to carry clothing; and neat iron luggage carriers can be had in a dozen different patterns.

TOURING AND FOOD.

When going on tour the first thing to decide is what will most be enjoyed, good scenery and medium roads; good roads and medium scenery, or what? No fixed distances can be laid down, as the wind, the state of the roads, or the advent of rain may play an unrehearsed but effective part in the proceedings of any day. Therefore never part from your luggage. There is nothing that differs so much in its capabilities as the human stomach, and therefore the sooner the better a boy starts on the principle that he will be either a fool or a physician at forty, if he does not ere that period ascertain what he can eat to the best advantage. If a heavy or "square" mid-day meal be taken, however, let at least one hour and a half ensue before resuming the day's journey; two hours for choice. As to drink, the less taken the better. No young man should require any stimulants, but, on the other hand, no boy or man, as a general rule, should drink water in a strange country place, therefore let mineral waters or milk be used as a thirst quencher, as there is more chance of their being pure than the ordinary country pump water. The man who tours on temperance principles, or who takes liquor only with his dinner after the day's work is done, will start fresh next day. Liquor taken *en route* urges a rider to over-exert himself, and reaction can only be the result. At the same time if a feeling of exhaustion supervenes after a long ride, a little stimulant should be taken.

CLUBS.

The choice of a club is an important matter. As a rider grows he desires to join a club. The largest club not only in cycling but in the world—another proof of the growth of cycling—is the Cyclists' Touring Club, generally known as the "C.T.C." It has over 22,000 members. Its headquarters are at 139 and 140, Fleet Street, London, and the subscription is two shillings and sixpence per annum with an entrance fee of one shilling. It is the most cosmopolitan club in existence, and its members vary from a peer of the realm to a day labourer or mechanic. It confers no social distinction, because provided a man's character is good, his social status does not interfere with his election. It confers certain advantages of which the following are some. It publishes a list of hotels at home and abroad at which cyclists will be welcome, and where they will, like a commercial traveller, know precisely what they will be charged for their bed, attendance, breakfast, lunch, or tea. There is a tariff for dinner, but dinners vary so much that a certain amount of haze sometimes hangs over the price. In some places, such as the Highlands of Scotland, Brighton, and fashionable watering-places, the C.T.C. ticket is an undoubted saving. At some other places, modest country towns for instance, the tariff of the club is often the ordinary tariff of the hotel. On the whole, however, it is three shillings and sixpence well spent to join the C.T.C., as one can choose the good hotels and go elsewhere at a town where the "C.T.C. house" is not a good one. The wearing of the uniform is a certain passport in the wheel world, and when thoroughly worked by an enthusiast, who appeals to the consuls (who are dotted all over the country) through the right channel for local information, the club

organisation, which is a credit to the secretary, Mr. Shipton, can be made very useful. The C.T.U. is comparatively easily entered. One writes to the secretary for a form, and gets one of the 22,000 members to sign as proposer and another as seconder. As regards other cycling clubs, when the time comes for a rider to join, he should consider the following points, namely, Are the members men of or about my own class, and can I afford the subscription and other expenses which I shall be drawn into? Most cycling clubs are fairly easy to enter; all are if the would-be member is "all right" socially and as regards "form." In every case write to the secretary for information as to how to join. The subscription of the London B.C. is £1 per annum, and the scale runs through many sums down as low as two shillings and sixpence; ten shillings and sixpence and five shillings being perhaps the most general figures for club subscriptions.

THE NATIONAL CYCLISTS' UNION.

This body, started as the Bicycle Union, had to change its title to that given above in deference to tricyclists. Lord Bury, now the Earl of Albemarle, a genial nobleman and an enthusiastic cyclist, was its first president. It was established not only to protect the interests of cyclists in and out of Parliament, as regards principles affecting the whole body generally, but also to avenge legally attacks on individuals, and likewise to watch the sport, i.e., the racing, side of cycling as apart from the pastime or purely recreative side. The Union arranges championship races and would proclaim a cyclist from riding as an amateur if he committed a breach of the code of amateur morals, or it would suspend him from racing as such for a limited period for a comparatively mild offence. It would resist any attempt by Parliament to harass or interfere with cycling on the road. It prevents, when it hears of them, any clubs from racing on the road, and it sometimes aids by money or legal advice cyclists who have been assaulted or injured wantonly by riders, drivers, or others on the high road. The subscription is small, being but one shilling per annum. The Union, which hails from 57, Basinghall Street, London, E.C., owes much to Mr. Robert Todd, solicitor, who was for many years its untiring honorary secretary; and it is the Cycling Parliament. Its "sessions," however, are somewhat dreary from a debating point of view to any but the most enthusiastic cyclist. The Union will supply draft rules for clubs about to be formed, but better and more simple rules have been published in the London Cycling Press.

PARTS OF A CYCLE.

Mindful that this article may, and probably will, be perused by many who are absolutely unacquainted with cycling, or with either bicycles or tricycles, it is desirable to describe the various parts:—

The tire is the india-rubber which runs on the road. It used to be invariably solid rubber, now it is, occasionally, hollow, and filled with air.

The rim, or felloe, is the angle iron which receives the rubber tire, and to which the spokes are fastened at their outer ends. In the best machines, instead of a solid angle iron, the rims are now specially made hollow as a U-shaped tube.

The spokes speak for themselves.

The hub is the boss or centre of the wheel, from which radiate all the spokes.

The axle is the round bar on which the hub is fixed, and which revolves in the bearings.

The bearings are the cups or receptacles (now in good machines lined with steel pellets known as balls) in which the axles revolve.

The cranks are the iron or steel "handles," which, being keyed (or bolted as in the case of detachable cranks) on to the driving axle, receive the pedals.

The pedals are the things on which the feet push. They are sometimes faced

with rubber and sometimes notched like a rat-trap to clutch more firmly on to the soles of the rider's shoes. Except for racing or road "scorching" (otherwise going as hard as possible), rubber-faced pedals are infinitely superior to rat-traps, as they deaden vibration on the leg in a very marked manner. Only one champion, C. E. Liles, has, however, ever raced with rubber pedals; but he invariably did.

The backbone is the main tube of the framework.

The forks are sometimes solid and sometimes tubular, and come from the backbone framework down to the centre of the wheels.

The step, brake, mud-guard, saddle, and spring speak for themselves.

A "diamond frame Safety" is a machine in which the tubes of the framework are more or less arranged in the form of a diamond. A cross-framed Safety is a machine in which there is one strong tube or backbone going straight from the head to the centre of the rear wheel of the machine.

The head also speaks for itself, but there are three kinds: the socket-head, in which a plain solid head works in the socket; a ball socket-head, in which a necklace of balls supports the head at top and bottom; and a centre steering head, which is one in which there is brazed into the front part of the backbone tube a solid piece with a cone at top and a cone at bottom, which work into concave cups secured to the head.

"Gearing" relates only to Safety bicycles and tricycles, not to an Ordinary bicycle, which drives by direct action on the pedals on the front wheel axle. Gearing is a means by which a small wheel, say 30 inches in diameter, can be driven so as to cover by the same number of revolutions of the feet a like amount of ground as if it were 60 inches in diameter. This is done by the chain wheels. Were the size of and number of cogs on both the chain wheels equal, the rider would simply drive a 30-inch wheel and have to pedal fast accordingly; but increase the size of the lower chain wheel, the one which the crank axle drives, and although you increase the force necessary from the leg, every revolution sends the 30-inch wheel flying forward as if it were a 60-inch wheel. When gearing first began, large wheels, say 56 inches, were proposed, and the rider's lower wheel was to be geared down to 50. This was found to give him power but lost him speed. It was discovered that small and therefore light wheels geared up were better than large ones geared down, and so they became as they now are—30 inches geared from 52 to 63 inches at choice.

ROADS.

The roads of England are, all round, the best in the world, and those in the south of England are far better than those in the Midlands or the north. Scotland has excellent roads, as a rule, but they are made of harder material than those of England. Irish roads are not good as a rule. America may be said generally to have no roads except in and near the well-known centres of civilisation. The "dirt" roads of America, i.e., virgin soil, may be good in certain weather, at other times they are chaos. Many of the roads in India are splendid, and very level. Dutch roads are mostly made of bricks—whole bricks. They afford good going close to the path, but soon get kicked up by horses in the centre. Belgian roads are vile, being mostly paved all over, and generally with round cobbles. French roads vary, but as a rule are not only excellent in surface but splendidly engineered. German roads are only fair and get very dusty in summer; the same may be said of Austrian roads. Italian roads are fairly good, and so are Swedish and Norwegian, but rather, occasionally very, hilly. Swiss roads are very fair, and although made through a hilly country, follow the valleys when they can. Russia, like America, is a roadless country, but Spain occasionally affords fair cycling.

RACING.

It is hardly necessary in an article intended for beginners to do more than touch on racing. Long before the novice is either able or willing to race he will have made many personal friends who are cyclists, each of whom will be full of his own theories as to how he ought to race. Let him hear all they have to say; try their methods, and then decide whether his own ideas or theirs aid him best to get into the first rank.

CYCLING CLOTHING.

The best advice that can be given to a cyclist is to dress as nearly as he does in ordinary life. It is the custom for some riders to wear ugly-looking shoes laced up the centre of the foot, occasionally to bare their knees, to leave collars, shirts, and neckties to take care of themselves, and to wear simply an under-vest and a coat, with a cricket cap to top the lot. Such a rider is an object on his cycle, but off it, in the coffee-room of an hotel for instance, he is simply terrible to look at. A man when riding should wear a soft light hat with a brim, a short coat lined, if at all, with flannel, an easy-fitting waistcoat to match, also lined with flannel, a flannel shirt *with a collar*. The nape of the neck is the point where the sun, when it does strike a man down, attacks him, and to protect it is a necessity. Damp warmth does not give sunstroke, but direct rays of the sun on the nape of the neck do. Knickerbockers, lined at the waist with flannel, should be worn with long stockings, and ordinary Oxford shoes. The rider then looks well on his machine, and can go into any company without appearing ridiculous amongst those who are attired in the ordinary garb of life.

CLOTHING ON TOURS.

It is not so injurious to be wet through with perspiration as it is with rain, for the obvious reason that the rain chills at once, whilst the perspiration does not chill till it begins to get cold itself. The salt in it also lessens the evil; but all the same it is not good for either young or old to remain too long in damp clothes, be the original cause of dampness what it may. Therefore on tours always provide for dry underclothing from the waist upwards, and see that the hotel servants (send a *douceur* to the cook to be certain) dry the damp garments ready for next day. One great thing in favour of cycling is that no matter how long the journey, the rider never gets footsore. He may, however, get saddle-sore, though not necessarily, and to remedy this there is nothing better than Fuller's earth. Every tourist should be provided with this.

SHOES AND PEDALS.

In the body of the article these items have already been mentioned, but they are worth a special paragraph. It is not so necessary to have special shoes for cycling as it is for running. It should be a *sine quâ non* to avoid boots as interfering with ankle action, and spats should be worn to provide warmth when it is needed for the ankles. There are riders, and good riders too, who think it advisable to have stitched or screwed on to the soles of their shoes bars of leather, between which the rat-trap pedal fits, but this is not requisite if a rider finds that he can keep his pedals nimbly without. These bars are hideously ugly, and uncomfortable to walk on. There are plenty of good riders who are not nimble on their feet, men in fact who could not dance, and they, though having splendid power in their legs, require adjuncts to nimbleness of the feet. No one who has tried both, and has an independent opinion of his own, will ever use rat-trap, *i.e.*, iron, pedals, in lieu of those faced with india-rubber. The rubber lessens vibration, and lessened vibration means a lot. Besides which, the rat-trap spikes destroy the soles of all ordinary shoes. Rat-traps are a fashion, not a necessity.

HANDLES TO USE.

The human hand, like the human stomach, differs so greatly that it is impossible to lay down any law as to what should cover the handles of a cycle. Personally the writer knows nothing better than horn, but he has hands always dry in the palms. With damp palms horn handles are apt to slip, and cork coverings may be substituted. All india-rubber handle ends are hot. The spade handles, or those necessitating anything coming between the fingers, should be avoided, the skin between the fingers being delicate and easily irritated. Grasp the handles in the way most comfortable to the hand, and this will generally be found to be as one would cling to a rail, namely, hands on top.

THE LAMPS TO USE.

Except in the case of a few Ordinary bicycles, hub lamps, which hang inside the spokes of the front wheel, are obsolete, and it is well that they are, for they added a grave danger to cycling. A hub-lamp becoming unhinged and falling amongst the spokes might mean broken limbs. Now practically all lamps are head-lamps, and if they fall off can hurt only themselves. The greater jar of the small wheel of the Safety rendered an increase in the anti-vibrating hangings of head lamps necessary, and ingenuity in the shape of springs, rubber buffers, &c., has given cyclists some splendid lamps. The best known makers are in Birmingham, but their wares are sold in every cycling depôt of note.

CHILDREN'S CYCLES.

As was mentioned in an earlier part of this article, the most crudely made, and most difficult cycle to move, is a child's tricycle horse. Nevertheless, children, young and old, grown up and growing up, all love motion on wheels, and because the exercise is a pleasure, they derive proportionately more benefit from it than if it were merely exercise, *i.e.*, one which appeals to the muscles only, not the brain. Therefore, as soon as possible, let a young child take to a regular tricycle; they are little more in cost than a tricycle horse, and infinitely better for, and more amusing to, the child.

BEHAVIOUR ON THE ROAD.

Good vigorous health tends to make lads and men noisy; and cycling being the prince of health-givers tends very much towards this; but the feeling should be checked at any rate as long as the rider is within sight and hearing of his fellow-beings. Nothing creates so bad an effect respecting cycling or any other sport than noisy behaviour which cannot be entered into even in spirit by the majority of the persons who witness it. Therefore strive always to be decorous.

HOW TO DESCEND HILLS.

Nothing is more "tricky" than descending hills. Hills are so deceptive to the eye that one may be on an incline without knowing it. Always approach a hill with care. There is no more horrible feeling than that of a machine slowly but surely overpowering one; say, on such a hill as Dover Castle hill or that into Folkestone. Therefore no person, and particularly no beginner, should ever ride a machine without a brake. There are times when a hill will overpower a rider, brake and all; in these circumstances make for the nearest ditch before the pace gets too severe. These are only warnings in case of actual need. As a matter of fact, the most ordinary care in approaching a steep hill with the brake well on will enable a rider to judge whether he can descend it safely or not. If not let him dismount while his machine is yet in hand. These remarks apply to bicycles fitted with spoon brakes only, acting on the rubber of the front wheel. Bicycles if they have band brakes, and all tricycles so fitted, can descend anything. Never remove the feet from the pedals until the bottom of the hill is clearly seen and the surface can be judged of.

TO LEARN "LEGS OVER."

All, or practically all, Safeties have foot-rests, and so have tricycles, but on an Ordinary bicycle the way to descend hills is legs over the handles, and this is how to learn it. Take a long easy slope of good road, and grasping the handles tightly, gradually lift up the left leg and place it over the handle, moving the left hand out of the way till the leg is up. Practise this several times, and then treat the right leg the same way, and "legs over" will have been learned.

MODERN CYCLING HISTORY.

Cycling has a short but brilliant history of the past. In endurance man mounted on a cycle has beaten the strongest and fleetest of domestic animals, the horse, out and out in a 24 hours' ride. What horse could compete against Montague Holbein, who in 1890 covered 336½ miles in 24 hours, on a Safety on the high road? Horses have trotted a mile rather faster than W. C. Jones did his mile at Paddington in 1890 in 2 minutes 20 seconds; but where is the horse which could cover 40 miles under 2 hours, as not one but several cyclists have done in the 50 miles championship? What horse could turn out morning after morning, and trot or gallop from Land's End to John O'Groat's to the tune of over 100 miles a day, as have some cyclists in the past few years? A practical knowledge of cycling tends to increase one's wonder at these "giant performances," instead of decreasing it.

STANLEY SHOWS.

The magnificent machines displayed annually at the Stanley Exhibitions prove what capital and mechanical genius can do and have done for the cycle.

HAMPTON COURT MEET.

The Hampton Court Meet, when on a "bright May-day morning" every year the London clubs used to turn out and show us how cycling had grown, is now a thing of the past, but before they were abandoned they had increased from about 25 men at the first meet to about 4,000, the riders covering some six miles of road. The reason for the abandonment of the meet was said to be its unwieldiness, but it really was because the large clubs found it so difficult to keep up their numbers as compared with the "new blood" in the shape of younger clubs, that they "cried off," and so the meet lapsed.

THE CYCLISTS' SOCIAL CLUB.

Finally must be mentioned the latest united move of cyclists. They in 1890 opened in St. Anne's Gate a fine club-house costing on lease a rental of £300 a year and overlooking St. James's Park. It was handsomely fitted up in the manner of a West End club house, and the lunches and dinner provided, though naturally not elaborate, were most admirably served, while the liquors bore comparison, both for price and quality, with those of any club in London. These latter items were mainly due to the cosmopolitanism of cycling; one of London's most experienced high-class restaurateurs being an enthusiastic cyclist, and giving the club the benefit of his knowledge. The Club was burned down on Christmas morning, but is being rebuilt.

FREEMASONRY OF CYCLING.

In the Cyclists' Club all "Freemasons of the wheel" are admitted apart from their social calling, provided they are vouched for as being personally "good form," and when the club-house shall be rebuilt it will be possible, at some time or other, to meet there everybody of note in the wheel world; and amongst the literature on its tables will be found all the wheel journals of Europe and America, including, of course, the representative cycling organs of England, namely, *Wheeling* (London) and the *Cyclist* (Coventry).

ATHLETIC SPORTS.

ATHLETIC SPORTS, under which designation we class feats of pedestrianism and of hurling heavy weights, but not oarsmanship or proficiency in pastimes, were popular pursuits at schools many years before they were taken up by the Universities, or before athletic clubs were formed among adults. Highland games used to be performed at the Annual Northern Meeting at Inverness, and to some extent the programme adopted at these gatherings formed the basis of the list of feats practised in school athletics, with the chief exception of Tossing the Caber, a feat which is essentially Caledonian. It will be seen, therefore, that some remarks and suggestions on this subject are especially in place in a work designed for boys.

The usual programme of an athletic sports contest runs very much as follows:—Short distance race; long distance ditto; one or more races at intermediate distances; a hurdle race; high jump and broad jump, with sometimes a pole jump; putting the shot; and throwing the hammer or throwing the cricket-ball. This last now seldom finds place in programmes among adult athletes. The usual sprint distance is 100 yards. A mile race is almost *de rigueur*, and sometimes there is also a two or three mile race, and a steeplechase in addition, as a still further test of stamina. A quarter-mile or 600 yards, and half-mile race will also be often found, for the benefit of those who can combine speed with a certain amount of stamina. Sometimes there is also a walking race.

SPRINTING.

Under this head are classed races which do not exceed 440 yards. In order to prepare himself for a hundred yards race (irrespective of the training, of which we shall treat generally in due course), the candidate cannot do better than begin by steady walking exercise, at a medium rate of three and three-quarter miles to four miles an hour, of about five miles in the day, to harden his muscles; but much walking exercise should not be indulged in within a fortnight of a 100 yards race, as it has a tendency to make the knees and ankles stiff. He may run about 200 yards twice during his walk, but should only run briskly, not violently; while he is "soft" it is a great mistake to put any undue strain on the ligaments of the body. As he becomes firmer in muscle, he may reduce the distance which he runs, and cover it more rapidly, until he can run the actual 100 yards at top speed. Still, it is wise not to run the course every day at his *very* best; the squeezing the last ounce out of the powers of the body too often tells a tale, even in so short a spin. If he runs the distance within two or three yards of his best powers this will do for two days out of three. Every third day he may see what he can really do, and try for himself whereabouts in the course he best makes his one principal rush. A 600 yards race is not frequently run at a uniform pace; there is some space which the runner covers at greater speed than any other. The runner should practise starts, which are all important in a short spin. He should stand thus: one foot (left for choice), about its own length and three inches more in front of its fellow, the body leaning very slightly forward, and the weight on the fore foot.

QUARTER-MILE RACE.

This is about the severest course which can be run; it requires both pace and stamina. The competitor should practise walking exercise in the same way as for shorter distance preparations, but he should run the racing distance only once a day, and not run the full distance at first; 250 yards will do to begin with,

and this he can increase as he gets fitter till he reaches full distance. He should not run himself quite out more than twice a week, and should not do the whole course at full pace within three or four days of his race; during the last day or two starts of 50 yards, and spins of 120, will suffice to keep him in trim. For a half-mile he should prepare himself in much the same way, but should double the preparatory and practice distances, beginning at 500 yards early in training.

MILE RACING.

For this more preparatory walking exercise is wanted, and the mile should be run daily at first, but to commence with, the pace should be little more than a jog, at about two-thirds of the runner's real powers. The speed may be increased as practice progresses, but the full distance should not be run out to the last gasp more than once a week, and not at all within four or five days, or even a week, of the race. The same for two miles, only that a still longer rest is needed between the last trial at full speed and the day of the race.

HURDLE RACING.

This class of race is too much reduced to a sort of "sleight-of-toe" among grown athletes. The distance and jumps are usually uniform—120 yards and ten flights of hurdles, three feet six inches high, and ten yards apart. The runner practises his step for these, and would be quite thrown out if the distance between the flights or their height were suddenly varied unknown to him. With growing boys there is less likelihood of the science of taking the hurdles in the stride becoming so studied, for their stride and strength are daily varying with growth. Adults usually do the "three step" movement, which has superseded the "four step." They "buck" the hurdles, trotting over them and not jumping them, lighting on the opposite foot from that on which they took off, and going on thence in their stride. Older boys may adopt the same step with advantage; mere lads will not have stride enough to cover the distance between the hurdles in three steps; they will be forced to run and jump, instead of "bucking." The best thing that they can practise is to alight after each jump on one foot only, and to step on with the next, taking off for the new stride with the foot on which they land. To learn this "bucking" step the runner should commence with low hurdles the regulation distance apart, and having acquired the step both as to take off, landing, and continuation of the stride, then increase the height until he can do the trick over full-sized obstacles. He can lower the hurdles by sloping them. He may prepare himself as to exercise in the same way as for 100 yards racing, and similarly practise starts.

For a steeplechase the runner should combine the jumping practice of hurdle-racing with the preparation for long-distance running.

JUMPING.

This is a feat which has greatly progressed with practice of late years. A quarter of a century ago any one who could jump five feet was looked upon as a wonder; and four feet eight inches often won a college or public school competition. Now those who have a speciality for it practise it so much that they soon add a foot or two to their range. The competitor requires to get himself as light as he can, and to avoid all heavy work with arms and back which may develop muscle where not wanted for jumping. The less lumber he carries the higher he will jump. He should practise daily, but never tire himself. The amount of run he takes to a high jump is very much a matter of

taste, but a dozen steps usually suffice. To time the "take off" is the great art, and the distance for taking off should be half the height of the jump, in front of the bar. The legs should be tucked well up, and the whole body thrown forward with just sufficient force to clear the bar, but all the rest of the power should be expended on the upward spring.

Two upright deals, with nails driven in, and holes bored to admit pegs, half an inch apart, with a light cross-bar laid on them, are all the apparatus needed for practice; the height jumped should be measured, and a piece of paper may be laid down to mark the take off, until the eye gets used to the distance. The starting off and landing should both be from the toes.

In wide jumping the best practice is to cut a gutter in the turf, whence to take off. The chief study, apart from development of power of spring, is to so time the step from the beginning of the run that the last stride before the spring may finish close on the edge of the take off, without shortening the stride to make it fit, else impetus is wasted. The jumper should be running at full speed when he takes his spring, as he thus gets the greatest possible impetus.

POLE JUMPING.

The pole jump of athletes is different from practical pole jumping. In the former the athlete quits the pole and throws it from him as he completes his spring, and so adds to his impetus; in the latter, crossing a country, the pole is retained, and dropped over the obstacle with the jump. A 12-foot pole, of ash (or pine for a light-weight), shod with iron spikes, is the usual implement. It should be held with palms facing each other, one hand above the other. That hand should be uppermost which is on the opposite side to the foot from which the pupil chiefly takes his spring—i.e., the foot which last leaves the ground. The lower hand should be about the height of the obstacle: this teaches the pupil to lift his whole body as high as his hands on each spring. The pole should be held straight in front, and in a high jump on the rise the feet should be thrown to the outside, the whole weight on the hands, back and shoulders stiff, so as to admit of the body being like a bar of iron, and horizontal as it passes over the bar. As the pupil progresses he will be able to elevate his whole body higher than his hands at the moment he clears the bar. A good jumper will clear more than the height of his pole. Swinging his whole body over, supported on his hands, and then springing with the hands off the pole as he quits it, he will clear his arms of the bar. In wide jumping (especially at a dyke, in the manner in vogue in crossing the fens), great care is necessary to keep the pole straight in the line of spring, else, if the jump is to one side, there is a risk of a fall in the water. So long as the pole is straight in front the body rises for the first half of the jump, and when it has reached its greatest elevation, its own weight takes it over; but if the pole stands to right or left the full elevation is lost, and so is the final swing of descent which bears the body to the further shore. The feet should be carried well in front in the broad jump, not swung round as in clearing a height.

THROWING THE HAMMER.

This sport is Caledonian in origin. The regulation hammer is 16lbs., and handle three feet six inches long; but boys require a lighter one. The most effective way of throwing is to swing the hammer round the body twice, the arms fully extended, and with a run, swaying the whole body with it in the last half-turn, then letting it go. The requisites are:—1. To let go in the right direction; 2. Not to lift the head of the hammer higher than the hands in the swing; 3. To time the step to the take off. It is a dangerous feat to be practised by a tyro within range of spectators; he may let the hammer go at the wrong moment,

and in the wrong direction. Seven feet is the regulation run. Plenty of dumb-bell exercise helps to harden the muscles of arms, shoulders, and neck for this feat, and for the next one mentioned.

PUTTING THE WEIGHT.

Sixteen pounds is the full-size shot for this feat, but young boys require a lighter one. The regulation run is seven feet, and the feet should not pass the "scratch" at or after delivery. The "put" must be with one hand (the right, as we presume the student to be right-handed). The putter stands on his right foot, with his right shoulder thrown back, and the weight on his right hand close to the shoulder. The left arm and leg are usually thrown forward to balance the body. Two hops are then taken on the right leg; at the end of the second hop the left leg touches the ground, but the right shoulder is still kept back, and the weight of the body is still on the right leg. A spring is then taken, and the body swung rapidly round a half turn, so that when the weight leaves the hand the right shoulder and leg are forward, and the left shoulder and leg behind. The object it will thus be seen is to propel the weight by the swing of the body, and as little as possible by the arm. The body must be stopped after the weight leaves the hand, for if the line is crossed it is "no put," although it counts as a "try."

THROWING THE CRICKET BALL.

Hardly a schoolboy is unable to "shy," yet the strongest arm is not always the most propelling for a throw. The secret of throwing is to keep shoulder, elbow, and wrist joints all loose when the arm is drawn back; then to hurl out the arm, to let all three joints straighten simultaneously, and to let the missile quit the grasp at that juncture. If any one joint straightens before the other, or the delivery is not timed to coincide with the triple straightening, power is lost. A run adds impetus to the throw.

TOSSING THE CABER.

This is essentially Scottish, and seldom, if ever, finds its way into English athletics. Nevertheless, we describe it, to complete the series of feats. The "caber" is a spar, or rather beam (a young tree), heavier at one end than the other. It is held perpendicularly, small end downwards, and balanced in the hands against the chest; then with a run the athlete "tosses" it, so as to make it fall on the big end and turn over. The "caber" is usually so big at first that no one can toss it clean over. If all fail, then a bit is sawn off, and another round is tried by competition, and so on until some one turns it clean over, so that the small end lies away from the direction whence it came. If more than one tosses it over, the straightest fall and farthest toss wins.

HARE AND HOUNDS.

This, or what is called a "Paper Chase," is an old-standing school recreation, which has at last developed into a sort of athletic sport—i.e., the competitors train for it, run against Father Time as well as against each other, and are just as keen to beat each other in the run home, and even more so, than to catch the "hares." Formerly the fun of a "paper chase" was to explore new country for each hunt; but when rivalry of records of "time" began to establish itself, standard courses became more popular, and the interest of finding the way over a new line became subservient to that of competing against the best recorded

pace of former performers over old lines of country. The sport is now nothing more or less than a steeple-chase on foot between the hounds.

In running a course of this sort, no "hound" can expect to take his fences in his stride, or to jump the majority of them at all. They are not made-up fences, such as are found on a regulation steeple-chase course of artificial creation, but are the *bonâ-fide* landmarks of enclosures, and would often prove too much for even a good hunter, unless the rider carefully picked a weak spot. The best costume is a sailor's guernsey, which leaves the arms free to play, keeps the body warm, and at the same time ventilates it; below, flannel trousers, the ankles and calves of them tucked into stout worsted stockings, gartered outside. This protects the legs against thorns better than mere stockings below knickerbockers, and the thorns in a hedge that has to be pierced through are no joke. Spiked shoes are better avoided; they are well enough on a running path or on turf, but over sticky ploughs they carry mud to the soles, and impede the runner. The best shoe is a brown leather or leather and canvas "rowing" shoe, or what would be a lawn tennis shoe but for having a leather *vice* an indiarubber sole. The runner does not want to run on his toes, but nearly flat-footed all the way. Judgment of pace is, next to training, the most important requisite, and this the runner can learn only by experience. The most distressing part of the run is often the early part of it, when first wind has gone and second wind has not come again. With second wind a good-plucked one strides along merrily. The pack should keep together, if only to hit off the "scent" at checks, during the early part of the run; if they want to run jealous, the last mile or two, when they have rounded in sight of home, is plenty of time to begin to race for the honour of pride of place. The "scent" is paper torn small, and strewn by the hares as they go. It is carried in canvas bags, and to ensure a pace one of the two hares can run a section of a circle, while the other cuts the arc and meets him at the end of the curve; then the one who has been husbanding his powers can take up the pace, while his colleague in like manner cuts across to meet him.

Long runs, steady exercise, careful diet, and especially early hours of bedtime, are requisite to prepare for a severe Hare and Hounds match. The best "sprinter" is often nowhere at the end of a mile or two of heavy ground in a run of this sort, and nothing but pluck and stamina combined brings the leaders to their places of honour at the finish.

WALKING.

Boys seldom have walking races. The gait of a walking race is ungainly, and is more exhausting than a run of greater speed. The walker ties himself down to an action of limb which abandons all spring and impetus. In a run he flies through the air between the touch of alternate feet on the ground, and takes off with a spring from a bent knee. In a walk he must progress "heel and toe." The heel must touch the ground first, and one foot must always be on the ground, else the gait becomes a run. The knee must be straight when the foot is put down and taken up. The chief art in walking is to "twist the hips." By twisting them at each step the stride is lengthened, and the leg carried forward by the swing of the loins, to the relief of the ordinary muscles which extend the leg.

DRESS.

With the exception of Hare and Hounds, for which we have already specified the most suitable dress, the costume to be recommended for athletic racing is as follows:—"Zephyr" jersey and cashmere "drawers" (which are,

in fact, loose easy trousers cut short just above the knee-cap). They should be loose enough to allow the knee to bend freely, and not to hamper the extension of the leg in the stride. No braces, but a buckle to support them. They fit better round the waist if the top is worked in a waistband of itself, with two buttons, and a buckle to adjust the girth. A short sock, barely reaching to the ankle-joint, elastic, of knitted wool. The shoe should be easy, no heel, the sole well covering the foot, and spiked. The spikes should be thin and sharp, so as to give a good footing, and yet not to stick in the path. No spike in the heel is best, and five spikes in the toes. In all short-distance running, the runner moves only upon his toes. The shoe should lace close round the instep, but should not pinch in any way. The athlete should keep well clothed in flannel wraps till the moment he is wanted to go to the post. On a chilly day it will greatly improve the play of his muscles if he can get some friendly attendant to stand behind him and chafe his calves to the last moment allowed.

In ordinary practice the runner may with advantage wear a woollen woven guernsey over his jersey, which he can peel off when he wants to run against time. He will find it convenient to have a pocket worked in the breast of his guernsey for his handkerchief, so as to be independent of his coat pocket, while taking his training runs. When he is only taking walking exercise, his flannel coat will not be *de trop*. It should be borne in mind that flannel is the attire for all violent exercise; that the body should never be allowed to chill afterwards; and that it should be well rubbed down, until the skin is clean and dry, before every-day attire is resumed.

WHAT TO ESSAY.

Each athlete has some strongest point. Many do not know what their best feat is. A man may run quarter-miles for ages, and be only second-rate at them, and suddenly find that he is really first-class at a mile. The pupil cannot too soon find out where his forte lies, and devote himself only to that. Also, in his special distance, he should ascertain by trials against the clock, and finally trial horses, where to make his chief effort—beginning, middle, or end of the course. No boy should attempt severe feats of endurance if his family are constitutionally delicate—at all events, until he has been examined and passed sound by a doctor. Nor if he feels palpitation of the heart, or coughs after a run, should he persevere in training himself for running.

TRAINING.

Boys do not require the severe training for feats of speed or endurance which is requisite for older persons. They have not the same tendency to accumulate internal fat, and are less disposed to lose their "wind." Nevertheless, they can improve their powers by hardening their muscles, and this they do with good food and exercise of the required muscles. The standard maxim of training is that work trains, diet keeps the body up to that work. Diet alone will not train. It will suffice if boys are well fed on good roast joints or broiled meat (pork and veal barred), with a modicum of poultry or fish to vary the bill of fare, and plain puddings now and then. Jam and pastry should be eschewed in training. With adults limited liquid is important, but it matters less with boys; still, they had better not drench themselves with fluid, even though it be only water; and just before a race the less they drink on the day the better, so long as they do not parch themselves thereby. They should have plenty of green vegetables: spinach, asparagus, and French beans best; then cauliflower or cabbage; not peas or broad beans if they can get the other vegetables mentioned. Potatoes will do them no harm, though objected to for adults in any quantity. Fresh fruit, vegetable-marrows, and artichokes should also be taken in moderation;

also oranges, and a dried fig or two at dinner. The great desiderata are exercise and sleep; of the latter at least nine hours, and with plenty of ventilation in the bedroom. Boys should not take exercise to any extent on very empty stomachs, before breakfast; they should keep the pores of the skin open with a daily cold tub and free use of rough towels. Exercise should be taken in flannel, which should be changed when the work is over, and the body should be well wrapped up the moment exercise is suspended; sweating does no harm, but a chill may be fatal. Boys do not need great reduction in weight, and it is better not to take exercise in heavy clothing for the sake of sweating off fat; they have little or no fat to get rid of. A boy should have fresh meat (not *rechauffés*) at least twice, and even thrice, a day; better three lighter meals of meat than two heavy gorges of it. Eggs may be taken, but not more than four or five in the week, lest they produce biliousness; and they should not be hard boiled. For drink, a pint of good table-beer in the day for a lad of twelve to fifteen, and more, up to a quart, for an older boy. If the weather be sultry, more fluid to a half-pint may be taken at dinner, or lunch, or supper, but it had better be water or beef-tea, or water with a spoonful of lime-juice. At breakfast, not more than two cups of tea, which is better than coffee, and should not be too strong.

AILMENTS.

Boils sometimes occur through the extra amount of flesh which the appetite requires, especially if enough green meat is not taken therewith. On its first symptom a tender pimple should at once receive care; half a teaspoonful of syrup of iodide of iron in a wine-glass of water, taken immediately before or after a meal, two days running, will usually cure the blood and check the boil. If the boil has much developed before any cure is attempted, it is then best to poultice it with linseed, and to get a medical man to lance it as soon as possible. A boil that breaks in time of its own growth and ripeness causes altogether much more pain, worries the system, when broken takes longer to heal, and drains the body more than a boil that is lanced, well bled for a minute or two, and then anointed and bandaged.

Blisters.—Lance the skin with a needle or clean penknife (*never a pin*—it has arsenic in it), and squeeze out the water. Leave the old skin on to protect the young growth underneath.

Strains.—*Thorough rest.* Pump cold water over the strained part, and rub with turpentine or other embrocation.

Corns.—If "hard," soak the feet in hot water, till the corns can be split off with the finger-nails. Never use a knife; only skilled chiropodists or surgeons should attempt cutting. A daily touch of caustic will keep a chronic corn down, but care should be taken not to burn the skin.

GENERAL RULES.

1. A competitor may have no attendant in a race or at the start.
2. If he starts before the word he may be disqualified, or put back a yard as a penalty.
3. He must keep his course; if he crosses or jostles an opponent he is liable to disqualification.
4. In hurdle-racing each runner has his own hurdles in front of him, and must keep to them.
5. In high jumps three tries are allowed at each height. In broad jumps, three tries altogether. In putting the weight, three tries; in throwing the hammer, two; in tossing the caber, one; until the next round begins (if at all).
6. An attempt to throw counts as a try; it is an *attempt* if the scratch-line is crossed by any part of the body in the essay. If the competitor stops short of the line he may try again; the same in broad jumping. In high jumping, if the bar is displaced it is a try.

LACROSSE.

THE NATIONAL GAME OF CANADA.

IN England it is a boy's pride to be the possessor of a cricket bat, and it is his ambition to get into the eleven at school; but in Canada his chief desires are a crosse, and a place in the school team. Lacrosse is as inherent to the youth of Canada as Cricket is to the youth of England, and it would be very hard indeed to decide which of the two pastimes more completely combines the requisites of a good sport—activity, skill, and steadiness. Englishmen, of course, almost naturally incline to the glorious game of Cricket, but there is undoubtedly a great deal to be said in favour of Lacrosse. There can be no comparison between the two games, for their natures are utterly opposed, but it is certain that, next to Cricket, Lacrosse requires more skill and more practice for the attainment of proficiency than any other game.

The actual invention of the game is shrouded in mystery, but there is no reason to doubt that it originated with the North American Indians. Indeed, the very few records that exist tell us that on all great fête or gala days a Lacrosse match between two tribes of these Indians was the chief—possibly the only—feature of amusement provided. There was apparently no limit to the number of players on these occasions, from one to two hundred frequently taking part, whilst the extent of the field was arranged in accordance with the numerical strength of the tribes engaged, and the goals were generally one, and often two miles apart. The Canadian white men learnt the rudiments of the game from the Indians, and considerable credit is due to them for having constructed so fine a game as Lacrosse from such rude materials. No more conclusive proof of its excellence could perhaps be quoted than the single fact that, notwithstanding its comparatively late adoption, it is, as our heading implies, the recognised National game of Canada.

Lacrosse is played in England only to a limited extent—limited, that is to say, when the many thousands who participate in Cricket, Football, and Lawn Tennis are taken into consideration. Its progress during the years it has been practised here has undoubtedly been slow; the number of clubs and of players have not increased rapidly, but still they *have* increased, and there can be no doubt that Lacrosse in its quiet way is fairly holding its own with its sister sports.

We find it a matter of some difficulty to satisfactorily describe Lacrosse in these pages, for the reason that it is so entirely different from any other pastime, and that its many peculiarities require to be seen in action to be understood aright. However, close attention to the following details will at any rate initiate a would-be player into its mysteries, and the experience he will gain in practice will teach him the rest. The first things to be obtained are a crosse and a ball, the former being the instrument with which the game is played. Its appearance will be gleaned from the drawing of it in Figs. 1, 2, and 4. It consists of a straight piece of wood, about an inch thick, and four feet long, bent into a semicircle at the top, with a piece of gut drawn from the tip of this semicircle to a point about eighteen or twenty inches from the straight end of the stick. The space thus formed by the stick and the gut is woven with more gut, and a network is made of a coarser and more pliable nature than that of a tennis racket. It is upon this network that the ball is played. The remaining eighteen or twenty inches of the stick constitute the handle of the crosse. The crosse of to-day is a great improvement upon that formerly used by both Indians and Canadians, but as these improvements are such as only the experienced player would understand,

we need not describe them here. The ball used is rather larger than a tennis ball, and is composed of solid sponge india-rubber. Like a cricket bat, a crosse has a right and a wrong side, a distinction that will be readily appreciated by the veriest tyro, for upon the right side the ball can be held, whilst upon the wrong it cannot—at least, not by novices.

Everything depends upon the way in which the crosse is held. If the player will take hold of the extreme end of the handle with his right hand, having the gut of the crosse towards him, and with his left hand grasp that portion of the stick where the handle terminates and the gut commences, he will be holding a crosse as it should be held. If he hold it very loosely he will find that the crosse (if it be a good one) will have a natural balance of its own, with the wooden side of it rather lower than the gut side, and he may be sure that the position it falls into is the correct one. He should then place a ball upon the network, and he will find that it will (if the crosse is properly held) at once roll towards the straight part (or backbone) of the stick, and then



Fig. 1. - THROWING.

proceed to roll along the backbone towards the semicircular end. This semicircular end (otherwise the point) should then be slightly raised, or the ball will drop from it to the ground. At the first few attempts the ball, doubtless, will drop to the ground, but as this happens in all cases, no beginner need fear that he is unusually awkward. Remember, that when resting on the crosse, the ball should always be against the backbone. Having mastered this, "throwing" becomes the next operation. Here let us lay down the golden rule that the ball must never leave the crosse at any other part than the point, and before doing so it must have rolled down at least a portion of the backbone.

A glance at Fig. 1 will now be of some assistance, and if the player will hold the crosse in the manner there depicted, being careful that the ball is in the proper position, and will, with a circular movement, swing it towards the left shoulder, he will find that the ball will travel rapidly down the backbone and fly off at the point—the greater the speed of the ball down the backbone the farther it will go. Like all other movements, this re-

Fig. 2. - THROWING.

quires practice, and failures will surely attend first attempts, but after a while the ball will be found to "bite" the stick, as it were, and success

will soon follow. The ball has frequently been thrown from 100 to 130 yards by means of this throw. Fig. 2 introduces us to another throw, and here the player will find some difficulty in bringing the crosse into position whilst the ball is upon it; but, if he will remember that the ball must *at all times* rest against the backbone (we cannot repeat this too often), he will soon attain his object. This throw is performed by bringing the right hand, which holds the end of the handle, sharply towards the body, and, as in the former throw, the ball will run down the backbone, and shoot from the point. There are a variety of other throws, all variations of the two described, which are the chief ones, but if the beginner will master these thoroughly, the others will

come to him naturally. Next we have an essential feature of the game, "Catching"—and this requires more practice and care for proficiency than any other particular. The novice will be almost certain to hold out his crosse like a frying-pan, and allow the ball to simply drop into it, which, of course, it will do, and immediately jump out again. To ensure a safe catch the point of the crosse should be pointed at the ball whilst it is in the air, and then as the ball reaches the gut the crosse should receive a slightly downward movement. In fact, the crosse should give way to the ball in the same way that a fielder at Cricket gives way to a ball when he catches it. Frequently the ball comes too swiftly to permit of it being caught at the first attempt; then it should be merely blocked, as it were, and be caught on the rebound. If the player has access to a blank wall the throw in Fig. 2 can be practised against it, and the ball can be caught on the return. We know of no better practice than this, as it enables one to become accustomed to the handling of the crosse, besides learning the actual points of throwing and catching—and the more advanced the beginner is in these rudiments the better he will play in the field.

We will proceed to give a slight outline of the game of Lacrosse. No limit

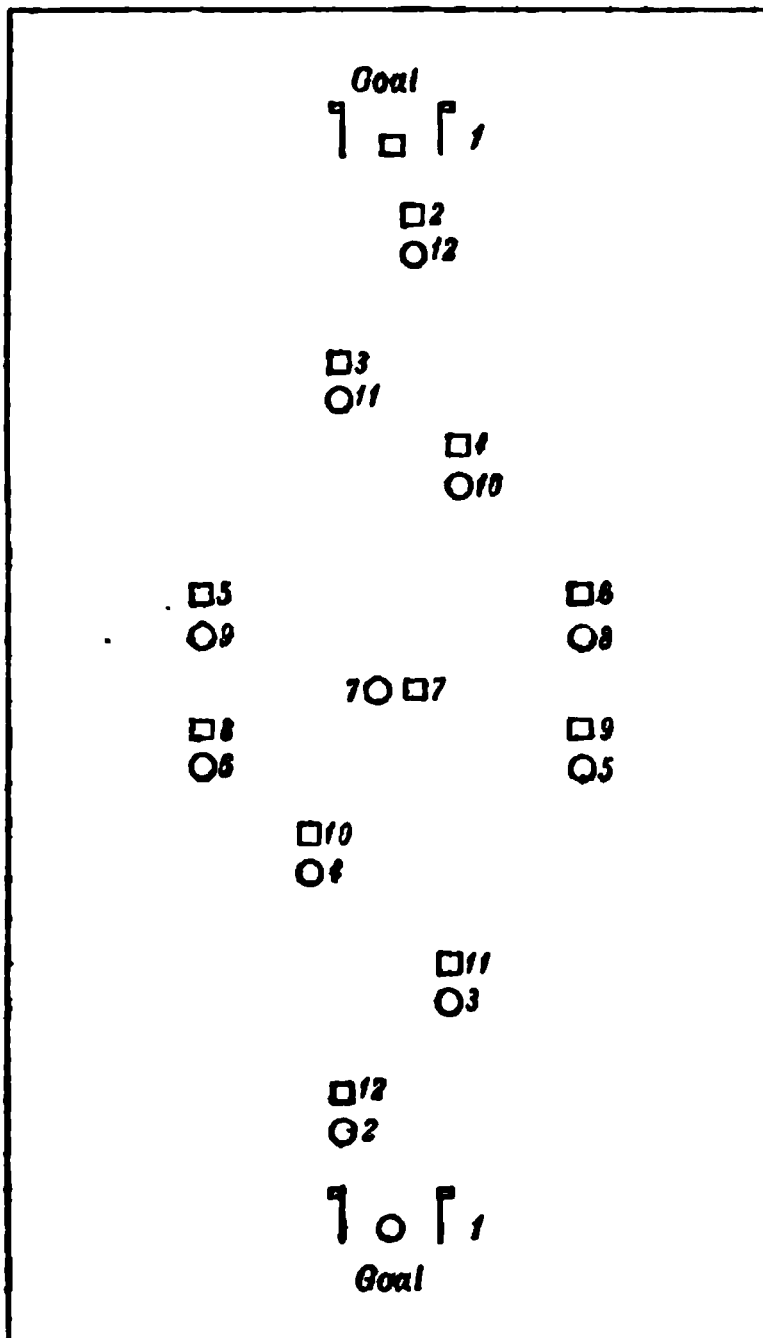


Fig. 3.—PLAN OF LACROSSE FIELD.

to the size of the field is necessary, though a boundary is often compulsory. The distance of the two goals from one another should be from 120 to 130 yards. A goal consists of two upright posts six feet high, and placed six feet apart, thus forming a space six feet square, through which the ball has to pass to score a game. There are no minor points, and there is no "off side" in Lacrosse, and a game usually lasts ninety minutes, ends being changed at half time. The team should number twelve each, and a glance at Fig. 3 will show the positions the twenty-four players should occupy. One side is represented by a square (□), and the other by a circle (○). The names of the various positions are:—1, Goal-keeper; 2, Point; 3, Cover-point; 4, Third Man; 5 and 6, Defence Fields; 7, Centre; 8 and 9, Attack Fields; 10, Third Home; 11,

Second Home; 12, First Home. It will thus be seen that each team extends the entire length of the field, from goal-keeper to first home, and that the players (with the exception of the goal-keepers) are in opposing couples. Every one knows the work of a goal-keeper. He has to do his best to prevent the ball from going through the 6-feet square he is defending, and, be it carefully noted, he is the only player on the field who may touch the ball with his hands. "Point" takes his position immediately in front of goal. This is considered the most responsible position on the field, and is always filled by the best and most reliable player. "Cover-point" stands a few yards farther from the goal being defended, and his position is only second in importance to that of "Point," and the same remarks apply to "Third Man" in a slightly lesser degree. These three men compare somewhat with "backs" at Football, and all must be steady, sure men. It is by them, and sometimes the goal-keeper, that the throw first described is so frequently used. The next men out are the "Defence Fields." These should be speedy men to run the ball down the sides. "Centre" is a sort of "rover" who has no fixed position, but should endeavour to help his side on the defence when they are in trouble, or assist them on the attack when they are assaulting their opponents' goal. The players hitherto described are (with the exception of Centre) confined to one-half of the field, and are called "defence men"—because their chief object is to defend their goal from the onslaughts of the enemy. The remainder of the team are called "attack men," because to them is left the task of attacking the opposing fortress—of scoring goals, in fact. They all need to be active, if not speedy men, and the throw of Fig. 2 is the one used by them more than any other. The reason that the players are separated into couples is that each "defence man" is opposed individually to an "attack man" of the other side. Thus "Point" has always to "check" (that is the recognised term) "First Home." "Cover-point" checks "Second Home." "Third man" checks "Third Home," and the "Defence Fields" check the "Attack Fields." A careful study of the diagram in Fig. 3 will explain this more clearly.



Fig. 4.—FACING.

The game is commenced by the two "centres" in the manner shown in Fig. 4. This starting position is termed "facing." When "Play" is called the centres will struggle for the ball; one will secure it, and immediately run with it towards his opponents' goal; if closely followed, he will pass the ball to one of his side who has managed to elude the attentions of his check, and he will at once make a sharp throw for goal. The ball will be stopped—say by the opposing "Point," who will make a long shy of 100 yards or more, and the game is immediately carried on at the other end of the field. The "attack men," by dodging and other means, do their best to become "unchecked," and by judicious passing of the ball endeavour to retain possession of it until one of them gets an opportunity of shooting at goal. The "defence men," of course, do all in their power to prevent the "attack men" from becoming unchecked, and at the same time try to secure the ball and throw it away from such dangerous proximity to their goal. Perhaps an "attack man" succeeds in obtaining a shot at "goal," but he throws wide, and the ball goes behind the posts. In this case it is generally advisable, for

"Goal-keeper" to go after it, as he is a yard or so nearer than any one else. "First Home" goes out to him, and "Point" takes "Goal-keeper's" place for the time being. "Goal-keeper" throws up from some distance behind "goal," the ball falling in the centre of the ground, and play takes place amongst the fielders. By them the ball is carried to either one end or the other, and the game continues in this way, the ball visiting every part of the field until a good and successful shot at one of the goals puts an end to it. The ball is then brought to the centre of the ground, and the next game is started by "facing," as at the beginning.

Lacrosse is essentially an unselfish game. The more freely a team will pass amongst themselves the more certain are they of victory. It is a game that has all the exercise, all the freedom, and all the manliness of Football, and one in which skill and activity are more than a match for mere brute strength. Like all games that are worth playing, there is a certain amount of risk—but this is confined to skin and other external abrasions. Broken limbs and internal injuries are unknown to Lacrosse. It can be played in both winter and summer, but a good light and a dry, even turf are decided advantages. Lacrosse is a game that requires to be seen to be appreciated and thoroughly understood, and we are sure that if it were better known than it is, it would be played to a much greater extent. It needs an introduction to some of our public schools, and then it would, perhaps, attain the position it deserves to hold as a thoroughly pure sport, containing no elements that are not healthy and manly.

LAWS OF LACROSSE.

Rule I.—The Crosse.

Section 1.—The Crosse may be of any length to suit the player, woven with raw hide or gut—not cord or soft leather. The netting must be flat when the ball is not on it. In its widest part the Crosse shall not exceed one foot. A string must be brought through a hole at the side of the tip of the turn, to prevent the point of the stick catching an opponent's Crosse. A leading string, resting upon the top of the stick, may be used, but must not be fastened, so as to form a pocket, lower down the stick than the end of the length-strings. The length-strings must be woven to within two inches of their termination, so that the ball cannot catch in the meshes.

Section 2.—No kind of metal, either in wire or sheet, screws, or nails, shall be allowed upon the Crosse. Splices must be made with either string or gut.

Rule II.—The Ball.

The Ball must be india-rubber sponge, not less than eight inches, and not more than eight and a quarter inches in circumference. It must weigh not less than four and a quarter ounces, and not more than four and a half ounces. In matches it must be furnished by the home club.

Rule III.—The Goals.

The Goals shall be placed not less than 100 yards, and not more than 150 yards apart, unless otherwise arranged, and in any position agreeable to the Captains of both sides. The Posts must be six feet apart, and the tops thereof, including any ornament, must be six feet above the ground. In matches they must be furnished by the home team.

Rule IV.—The Boundaries.

The Boundaries of the field of play shall be agreed upon by the Captains before the commencement of the match. Should the ball be thrown out of bounds, the Referee shall call "Stand," and the ball shall then be "faced" by the two nearest players, four yards within the bounds at the point where the ball went out.

Rule V.—Umpires.

Section 1.—There must be only one Umpire at each Goal, who shall be agreed to by both Captains before the commencement of the match. They shall not be changed during the progress of a match without the consent of both Captains. They shall not change goals during a match.

Section 2.—No Umpire shall, directly or indirectly, be interested in any bet upon the result of the match. No person shall be allowed to speak to the Umpires, or in any way distract their attention.

Section 3.—The Umpire shall stand behind the posts. In the event of "goal" being claimed, he shall at once decide whether or not the ball has fairly passed through the goal-space, his decision being simply "goal" or "no goal." His decision shall be final, without appeal, and he shall not be required to give a reason.

Section 4.—In the absence of a Referee, the Umpires shall assume his functions, as set down in Law VI., each over his own half of the field. One only shall act as timekeeper and starter, failing a Referee, and this shall be decided by tossing.

Rule VI.—The Referee.

Section 1.—The Referee shall be selected by the Officers of the competing teams at any time prior to the match. He shall be a disinterested person.

Section 2.—Before the match begins, he shall see that Umpires have been properly chosen.

Section 3.—He shall draw the players up in lines, and see that the regulations respecting the crosses, ball, goals, and spiked shoes, &c. &c., are adhered to. He shall ascertain the length of time the match shall last, directly from both Captains, and he shall be sole timekeeper and starter.

Section 4.—When a "foul" claimed by any player has been allowed—or in case of injury or accident, Law VIII., Sects. 2 and 3—the Referee shall immediately call "Stand." If the ball enter goal, after "Stand" has been called by the Referee, it shall not count.

Section 5.—The infliction of penalties (Law XII.) shall be in the province of the Referee, without appeal, and any side rejecting his decision, or refusing to continue the match, shall be declared the losers.

Section 6.—The Referee shall arbitrate in all disputes between the Captains, and his decision shall be final.

Section 7.—At the commencement of each game, and after "Stand" has been called, the Referee shall see that the ball is properly "faced."

Rule VII.—Captains.

Section 1.—A Captain to superintend the play shall be appointed by each side previously to the commencement of a match. They shall be members of the club by whom they are appointed. They may or may not be players in a match; if not, they shall not carry a crosse, nor appear in Lacrosse uniform. They shall be the mouthpiece of their respective teams in all disputes, in which they may be assisted by one player selected by them, and shall report any infringement of these Laws during a match to the Referee.

Section 2.—Captains shall arrange, previous to a match, the length of time it shall last, and shall toss for choice of goals.

Rule VIII.—The Teams.

Section 1.—*Number.* Twelve players shall constitute a full team. They must be regular members of the club they represent. Should one side be deficient in numbers at the time fixed for starting the match, their opponents may either limit their own numbers to equalise the sides, or compel them to play with as many as they have.

Section 2.—*Wilful Injury.* Should a player be incapacitated from playing through wilful injury from an opponent during a match, his side shall be at liberty to replace such injured player by a fresh man, or compel the other side to take off a player to equalise the sides. No change of players may be made after a match has commenced, except in cases of injury during the game.

Section 3.—Accidents. Should an accident occur to any player, which, in the opinion of the Referee, incapacitates him from playing, the other side must put off a man during his absence.

Section 4.—Spiked Soles. No player may wear spiked soles under any circumstances. The soles must in every case be india-rubber if boots or shoes are worn.

Section 5.—The players on each side shall be designated as follows:—1, "Goal-keeper;" 2, "Point;" 3, "Cover-point;" 4, "Third Man;" 5, "Right Defence;" 6, "Left Defence;" 7, "Centre;" 8, "Right Attack;" 9, "Left Attack;" 10, "Third Home;" 11, "Second Home;" 12, "First Home."

Rule IX.—The Game.

Section 1.—Each game shall be started by the centres facing at the centre mark, and when both sides are ready the Referee shall call "Play."

Section 2.—A match shall be decided by a majority of goals taken within a specified time, unless otherwise agreed upon. A goal shall be scored by the ball passing through the goal-space from the front, not being propelled with any part of the foot or leg.

Section 3.—Should the ball be accidentally put through either goal-space by one of the players defending it, by whatsoever means, it shall be counted a goal to the opposite side. Should it be put through by any one not actually a player, it shall not count.

Section 4.—In the event of a goal-post being knocked down during a match, and the ball put through what would be the goal if the post were standing, it shall count goal for the attacking side.

Section 5.—When goal has been claimed and allowed, the ball shall be again faced in mid-field, but when disallowed, it shall be faced where it is picked up. In no such case shall a ball be faced within ten yards of either goal-post.

Section 6.—Ends shall be changed at "half-time" (unless otherwise agreed upon), when either side may claim not more than ten minutes' rest; such rest not being counted as occupied in play.

Section 7.—The Goal-keeper, while defending goal within the goal-crease, may put away with his hand or foot, or block the ball in any manner with his crosse or body.

Section 8.—Any player is "out of play" if he drop his crosse during a game, and may not touch the ball or impede an opponent in any way until he recovers his own crosse.

Section 9.—A match is ended by the Referee calling "Time."

Rule X.—Fouls.

Section 1.—No attacking player may be within 6 feet of either goal-post, unless the ball shall have passed "Cover-point's" position on the field. Such position shall be marked 10 yards in front of the goal. A player thus trespassing shall be out of play, and no goal shall count, if taken, while he is out of play.

Section 2.—No player shall interfere in any way with another who is in pursuit of an opponent.

Section 3.—No player, except the Goal-keeper (Law IX., Sec. 7), may touch the ball with his hand, save when the ball lodges in a place inaccessible to his crosse, or about his clothing or person. The player picking it up must "face" with his nearest opponent, all other players standing in the positions they may then occupy.

Section 4.—Should the ball catch in the netting, the crosse must immediately be struck on the ground, and the ball dislodged.

Section 5.—Kicking the ball under any circumstances with the foot or leg is foul play (except in the case of the Goal-keeper, Law IX., Sec. 7), but this does not prevent a player from stopping the progress of the ball with foot or leg.

Section 6.—No player shall grasp an opponent's crosse with his hands, hold it with his arms or between his legs or under his feet, or kick it.

Rule XI.—Rough Play.

Section 1.—No player, with his crosse or otherwise, shall hold or trip another, nor push with the hand; nor shall any player deliberately charge or shoulder an opponent, nor

wrestle with the legs entwined, so as to throw an opponent. This does not prevent the use of the "body-check," provided the same be strictly as defined (Law XIII.), nor the pushing an opponent with the shoulder in ground-scuffles.

Section 2.—No player shall deliberately strike another, or threaten to do so, under any circumstances, and any one considering himself purposely injured during play must report, through his Captain, to the Referee.

Section 3.—The check commonly known as the "square" or "crosse" check, which consists of one player charging into another with both hands on the crosse, so as to make the stick meet the body of an opponent, is strictly forbidden.

Section 4.—No player shall throw his crosse under any circumstances.

Rule XII.—Penalties.

Section 1.—For breach of Law X., Sections 2, 3, 4, 5, and 6, a "face" shall be given, at the place where the foul occurred, yet not nearer either goal-post than ten yards, unless the "foul" be made by the defending party.

Section 2.—Claiming "fouls" on trivial grounds, as when, in the opinion of the Referee, no foul was intended, cannot be tolerated, and the Referee shall first caution a player so offending, and, if persisted in, shall disqualify him for that particular game (not match). Should the Captain (non-playing) so offend, the same penalty shall be inflicted upon him as though he were a player.

Section 3.—For rough play, Law XI., Sections 1, 2, 3, and 4, the penalty for first offence shall be disqualification for remainder of that particular game or match. See Law VI., Section 5.

Section 4.—The Referee shall be bound in all cases to inflict one or other of these penalties, but only when appealed to by the Captain of the complaining side.

Rule XIII.—Definition of Terms.

GOAL is the space contained between the two posts.

GOAL CREASE shall be a ground-space six feet square in front of the goal-posts, having for one of its sides the line between the posts. If not marked, it shall be left to the Umpire to decide.

FACE.—The ball shall be placed upon the ground between the crosses of two opponents, and each of them shall have his left side towards the goal he is attacking. They shall not move till "Play" has been called.

TRIPPING is the use of the legs, feet, or crosse, to throw an opponent.

HOLDING shall mean clutching with the hand or arm, or detaining an opponent between the two arms and the crosse, or placing the crosse against his body so as to impede his movements.

BODY-CHECK is the placing one's body in the way of an approaching opponent, so that the latter is simply impeded. No checker shall use force in the body-check.

STRIKING means the giving a deliberate blow with either crosse or hand.

CHARGING or **SHOULDERING** implies motion and unnecessary force in checking, and is forbidden, because the object should be to play the ball and not the man.

DRAW means equal number of goals gained at call of "Time."

STAND.—The ball is dead when the Referee calls "Stand," and no player shall move until the Referee calls "Play."

KNURR AND SPELL, OR NORTHERN SPELL.

THIS is a game that has long been very popular in the neighbourhood of the towns on the Yorkshire moors, and is more or less played throughout all the Northern English counties. Beyond their borders, however, until of very recent date, the game was unknown either by name or practice. Newspaper reports of Knurr and Spell matches have from time to time directed attention to the game, and it would seem that it has now a tendency to spread itself beyond those districts where it has so long found a home. Like Golf, it requires a

large open space; and where such spaces are to be found there is no reason why Knurr and Spell should not rival Golf in the number of its devotees. Like Golf, too, it is essentially a game of hitting—hard, skilful, and practised hitting. It embraces in itself also many of the peculiarities of the minor game of Trap, Bat, and Ball, and is, doubtless, of similar origin, although it demands much more application and attention before any degree of proficiency can be attained.

The "knurr"—or "nurr," as it is sometimes spelled—is a small boxwood ball, perfectly round, and about an inch in diameter. The "spell" is that which answers to the trap in the simpler game, and it is important that it should

KNURR AND SPELL—THE DRIVE.

be selected with great care, for, it matters not how proficient the player may be, if the spring or springs of his spell are badly made or adjusted, his play will fail to secure him rank among his competitors. The principle of the spell is that of a spring regulated by a thumb-screw, the one end of the spring being secured to an iron back or to a wooden board, secured by iron pins in the ground (see figure). The spring has fixed on it, at about two inches from the loose end, a small cup for the reception of the knurr, and before playing, the loose end of the spring is secured by a weighted toothed rack working on a loose pivot. The spring should be adjusted to the requirements of the player by means of the thumb-screw. The spell is supplied from the foundry of any ordinary steel or iron founder, and its cost in England ranges from fifteen to thirty shillings. The weapon with which the knurr is struck is called a "pommel," and is sometimes made like an ordinary billiard cue, with a small block of wood at one end, and at the other is padded and encircled with string, to form a firm grip for the hand. Other pommels are made almost exactly similar in shape to the bagatelle cue ordinarily used by ladies.

To play the knurr, the spring of the spell is released by letting down the

toothed rack that has secured its otherwise loose end, and this action will jerk the knurr upwards; the pommel is then swung round with the whole force of the hands, arms, and shoulders combined, so as to catch the knurr when about on a level with the player's chest (see figure), and if the hit be successful the knurr is likely to be driven off to a distance of 200 yards or more. The hit, to count, must be so managed that the knurr is neither split nor cloven, as in the event of the knurr being damaged the hit is not allowed. The game is one of individual skill, and each player plays for his own hand, the longest hit winning.

In some districts, where the game has become general, the heaths or commons are staked out by means of pins or bobs placed in the ground at distances of twenty yards apart. This arrangement avoids the necessity of measuring each hit, as sometimes matches or games are played and decided upon the largest score made in a given number of hits, rather than as above by the longest distance covered by any one hit. Each distance of twenty yards then is made to score one. It is usual in matches of this description for every player to bring his own spell and a supply of knurrs, and for each player to have five consecutive rises of the knurr. Ten minutes are allowed after the spell is fixed to adjust the spring to the tension required. In order to allow for the knurr not being sent in a direct line from the spell, it is customary to mark out the ground in the form of a triangle, each side of which should be about 250 yards long. A row of pins or bobs should be placed straight away from the angle at which the spells are fixed, and also along the sides of the triangle, meeting at that angle; additional rows should also be fixed on each side of the centre row, half-way between that and the sides of the triangle. The bobs are numbered according to the number of twenty yards they are from the spells, each completed twenty yards only counting towards score. No score may be allowed until the knurr has been inspected and found to be perfect as when it was first placed in the spell. As might be supposed, the game is best when played with, rather than against, the wind.

SKITTLES.

THE game of Skittles is very differently looked upon in various parts of the country and among different people. As played in the skittle-alleys attached to low public-houses, it cannot possibly be recommended; but given a good skittle club, with an alley free from pernicious surroundings, and, not even excepting billiards, is there any game played under cover that calls more upon the skill and strength of the player. Private skittle clubs are much more common than they formerly were, and the game is indulged in now by people whose respectability is not to be impugned. In many country districts it is quite usual to find a skittle-ground laid down in some shed or out-building of every decent-sized farm homestead, and many are the "floorers" obtained thereon by the farm labourers on wet days, when they would, in the absence of this amusement, be wasting their time in some neighbouring beer-shop.

A skittle-ground consists of planks laid down and fixed according to the annexed plan (Fig. 1). As the ground will be a permanent structure, it is necessary that the planks should be of stout elm, or other hard wood, and well fitted. The pins (Fig. 2, A) weigh from seven to nine pounds each, and are set up in three rows, as shown in the diagram (Fig. 1). The skittle-ball (Fig. 2, B) is shaped somewhat like a flat cheese, rounded at the edges, and should weigh from twelve to fourteen pounds. The player is stationed

at a distance from the front pin of about a dozen yards, and his play is to throw or pitch the ball so as to knock down as many as possible of the pins or skittles. The pins, to count, must be fairly knocked down by the ball itself or by a pin or pins that it has caused to fall. Any pin knocked down by a rebound of the ball or by a rebound of a pin is foul and does not count.

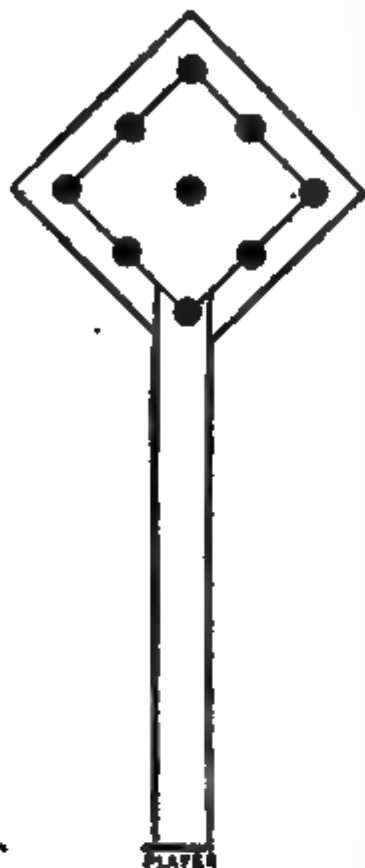


FIG. 1.—PLAN OF SKITTLE-GROUND.

There are several ways of scoring for game: the one is to make an exact score of thirty-one in the fewest possible throws, each pin knocked down scoring one; on the final hit, if the number of thirty-one is exceeded, the number obtained in that hit does not count, and another throw is allowed. Another mode of scoring is for the players alternately to throw at all the pins and each one to secure as many as possible, the ties playing again for conqueror. The best game is a game of two players, or of two sides of players, in which each player is allowed not more than three throws to clear the board; in that case, a floorer, or when the whole of the pins are knocked over in one throw, counts three; two throws to clear the board count two; three throws count one; but if after the third throw any pin remains standing on the board, a duck's egg (0) is the score. The scores are added together at the end of the play to ascertain the conquering player or side.

The only play that will secure a floorer is to throw the ball with a good round-handed swing, imparting to the ball what in billiards would be called a "side," and so

that the edge of the ball alights on the right-handed shoulder of the front pin. A little practice of this throw will very soon secure a degree of proficiency very startling to those not in the secret, and two floorers out of three throws will not be at all an unusual average.

The game of Skittles is occasionally played with four only of the pins, set up at the four different corners of the square. This game is more difficult to get large scores at, and is not nearly so good a game as that played with the full number of pins.



FIG. 2.—SKITTLE PIN (A) AND BALL (B).

DUTCH SKITTLES.

This is a version of the ordinary game, except that the ball with which the game is played is bowled instead of being thrown. The ground should be marked off at its sides, and grooves cut thereon for the ball to run on. A slight bias is given to the ball, which is otherwise round, and the centre pin is usually made a little taller than the remainder, it being sometimes made a condition of the play that the centre pin must fall first or no pins count.

THE AMERICAN GAME OF BASE BALL.

BEFORE entering upon the details of this famous American game, it will not be amiss to consider briefly

ITS ORIGIN AND THEORY.

Cricket, in its earliest phase, probably will be found to be a variety of the older game of Rounders; to this ancient English game of ball, too, does American Base Ball owe its origin. But the latter, which has become the national game of the United States of America, differs materially from the English game of "Rounders." True, both are played on a diamond-shaped field and with a round bat and ball; but there is a great difference between the manly game of Base Ball, as played by the American professionals, and the English schoolboy game of Rounders, as much so, indeed, as between draughts and chess, both of the latter games being played upon a chequered board. In fact, to enter upon a contest for the palm of superiority in the American game, and to display the skill in pitching, batting, and fielding which Base Ball requires, needs men of pluck, nerve, and presence of mind—courageous and intelligent fellows, who have their wits about them; for the game, when played up to its highest mark, is anything but a boys' game in any respect, as the amount of fatigue involved, and the injuries frequently sustained, fully prove.

Nevertheless, Base Ball can be played and enjoyed by boys as well as men, for its theory is simple, and when played by amateurs the demand for those qualifications which make a player excel in professional contests is of course not so great.

The theory of Base Ball in brief is as follows:—A space of ground being marked out on a level field in the form of a diamond, with equal sides, bases are placed on the four corners thereof. The contestants include nine players on each side—one side takes the field and the other goes to the bat. When the field side take their positions the pitcher delivers the ball to the batsman, who endeavours to send it out of the reach of the fielders, and far enough out on the field to enable him to run round the bases, and if he reaches the home base—his starting-point—without being put out, he scores a run. He is followed in rotation by the others of his side until three of the batting party are put out, when the field side come in and take their turn at the bat. This goes on until nine innings have been played to a close, and then the side scoring the most runs wins the game.

It will be readily seen that the theory of the game is simple enough, and it is this simplicity of construction which forms one of its chief attractions for the masses; and yet to excel in the game as a noted expert requires not only the possession of the physical attributes of endurance, agility, strength, good throwing and running powers, together with plenty of courage, pluck, and nerve, but also the mental powers of sound judgment, quick perception, thorough control of temper, and the presence of mind to act promptly in critical emergencies.

THE FIELD.

A Base Ball field should be at least 500 feet in length by 450 in breadth. The in-field should be level, and covered with well-rolled turf of fine small grass and clover. The grass should be frequently cut by machine; this will cause it to become velvety and close. Of course the ground from the pitcher's position to that of the catcher should be bare of turf, some eight feet in width, and laid with hard dry soil, and in such a manner as to throw off water. The edge should be

level with the turf border. The paths on the lines from base to base—three feet in width—should also be laid with hard soil, and also a circle around each base. The in-field, or "diamond," as it is technically called, is laid out as shown in the appended diagram (Fig. 1).

HOW TO LAY OUT A FIELD.

There are several methods by which a Base Ball field may be correctly laid out and measured, but the following is the most simple plan:—Having determined

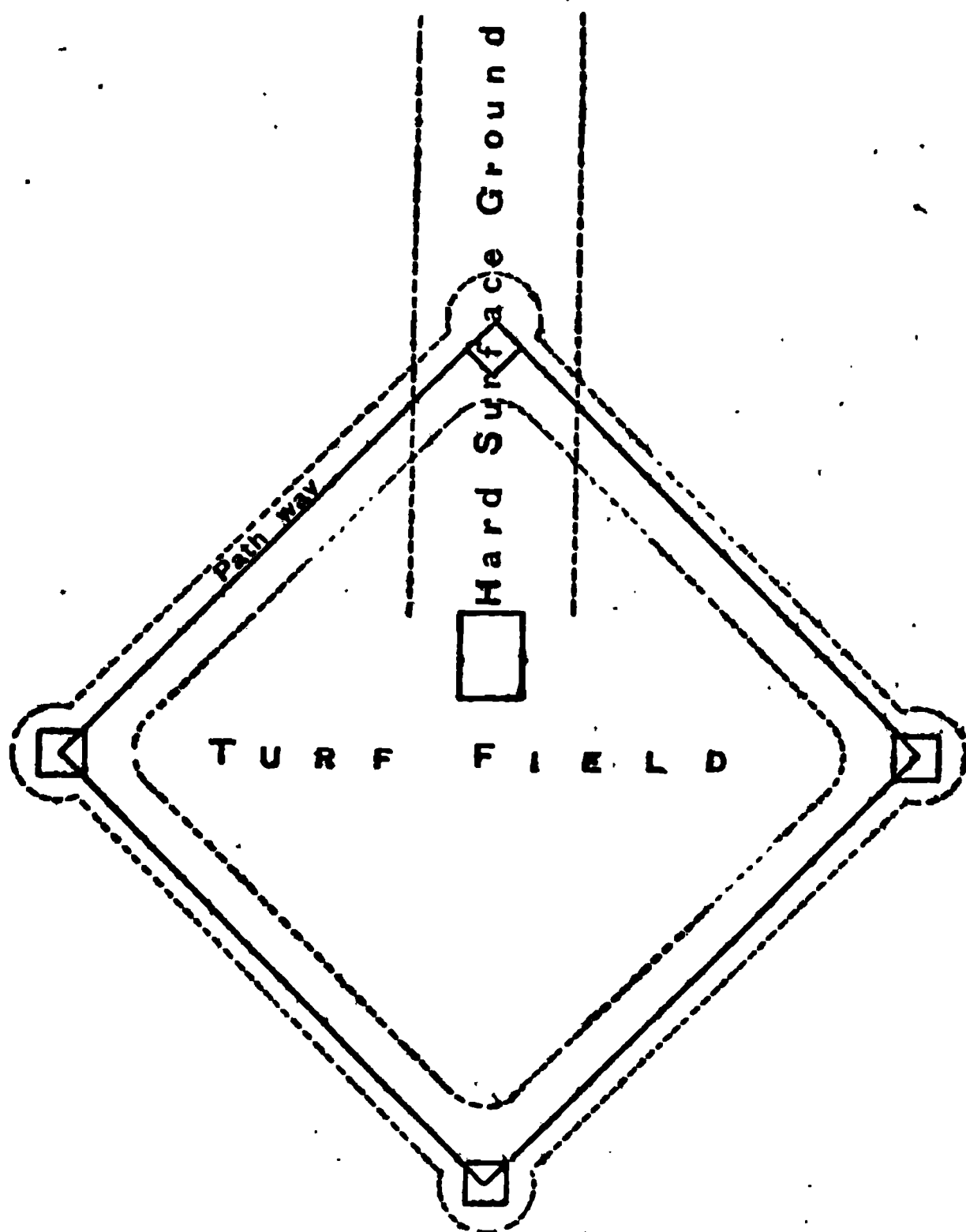


Fig. 1.—PLAN OF THE IN-FIELD, OR "DIAMOND."

on the point of the home base, measure from that point down the field *one hundred and twenty-seven feet four inches*, and the end will indicate the position of the second base; then take a cord *one hundred and eighty feet long*, fasten one end at the home base, and the other at the second, and then grasp it in the centre and extend it first to the right side, which will give the point of the first base, and then to the left, which will indicate the position of the third; this will give the exact measurement, as the string will thus form the sides of a square whose side is ninety feet. On a line from the home to the second base, and

distant from the former *forty-five feet*, is the front line of the pitcher's position, the back line being six feet farther, on the same line. The foul-ball posts are placed on a line with home and first base and home and third, and should be at least one hundred feet from the bases. As these points are intended solely to assist the umpire in his decisions in reference to foul balls, they should be high enough from the ground, and painted, so as to be distinctly seen from the umpire's position. Flags are the best for the purpose.

From the diagrams of the field (Figs. 1, 3) it will be seen that the diamond field forms a square, the sides of which are thirty yards. On the corners of this square are placed the four bases, each of which must cover a foot square of space. The home base must be of white stone or marble, so fixed in the ground that one of its corners faces the pitcher's position, and it must be level with the surface of the ground. The other three bases are canvas bags, fastened to posts sunk in the ground on each corner of the square located to the left, the right, and the rear of the pitcher's position. The batsman's position is within a space of ground three feet by six feet, located one foot distant from the home base, and three feet back and in front of the line of the home base, the latter of which extends three feet on each side of the home base. The accompanying diagram shows clearly how the batsman's position is marked out (Fig. 2).

The full diagram of a field, showing the position of the players, will be found in Fig. 3.

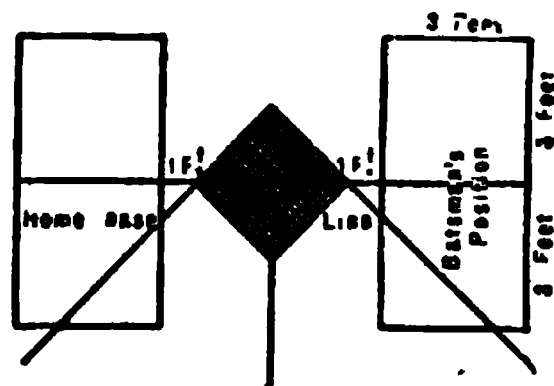


Fig. 2.—PLAN OF BATSMAN'S POSITION.

THE NINE PLAYERS.

The Catcher and Pitcher.—The catcher and pitcher of a Base Ball nine are technically known as the "battery" of the team, and on the skill displayed by these two players, in playing well together, largely depends the success of the nine. Of course it is necessary that the in-field and out-field support of the pitcher should be good; but half the battle lies in his having excellent support behind the bat. The catcher and pitcher should always have perfect understanding with each other in regard to their respective movements. Strategy is as important an element of success on a Base Ball field as on the field of battle. The pitcher and catcher should have a code of signals between them, and they should practise these signs until they can read them as easily as their letters. Thus, when the catcher sees an opportunity for the pitcher to catch a base player napping off his base, a certain signal should be given by which the pitcher may understand that he is to throw to the base promptly. Again, if the pitcher is familiar with a certain habit of the batsman before him of hitting at a favourite ball, he should give the catcher a sign informing him that he is going to send in a slower or swifter ball or a higher or lower one than ordinarily is pitched.

The Catcher.—Much of the success of a nine depends upon the ability of the catcher, and it is, therefore, requisite that he should be an excellent player in his position, and to excel as catcher he should be able to throw with great accuracy and speed a line ball a distance of fifty yards, and be able to stop swiftly-pitched balls and low grounders, and be especially on the alert in judging of foul-bound balls, besides having the nerve to face sharply-tipped balls direct from the bat. The ordinary rule is, when the striker has made his first base, for the catcher to come up close behind the bat, in order to be in a position to take the ball from the pitcher quick enough to send it to second base, in case the base runner tries to steal a base on the pitcher. When no men are running bases, then the catcher retires farther back.

The Pitcher.—The pitcher of a Base Ball nine occupies the most important position of the nine, and the one most difficult and responsible to fill. His position is within the lines of a space of six feet by four. The rules require him to deliver the ball while standing in his position, and when in the act of delivering, or in making any preliminary motion to deliver the ball, he must have both feet within the lines of his position, and he cannot take a step outside the lines until the ball has left his hands. Should he do so he incurs the penalty for

bowling. He is allowed to deliver the ball to the bat in any way except by an overhand throw or by any round-arm movement, as in bowling in cricket; therefore, he can send in the ball by an underhand throw, provided in so doing he swings his arm perpendicularly to the side of his body, and forward below the waist. He should bear in mind the important fact that the true art of pitching

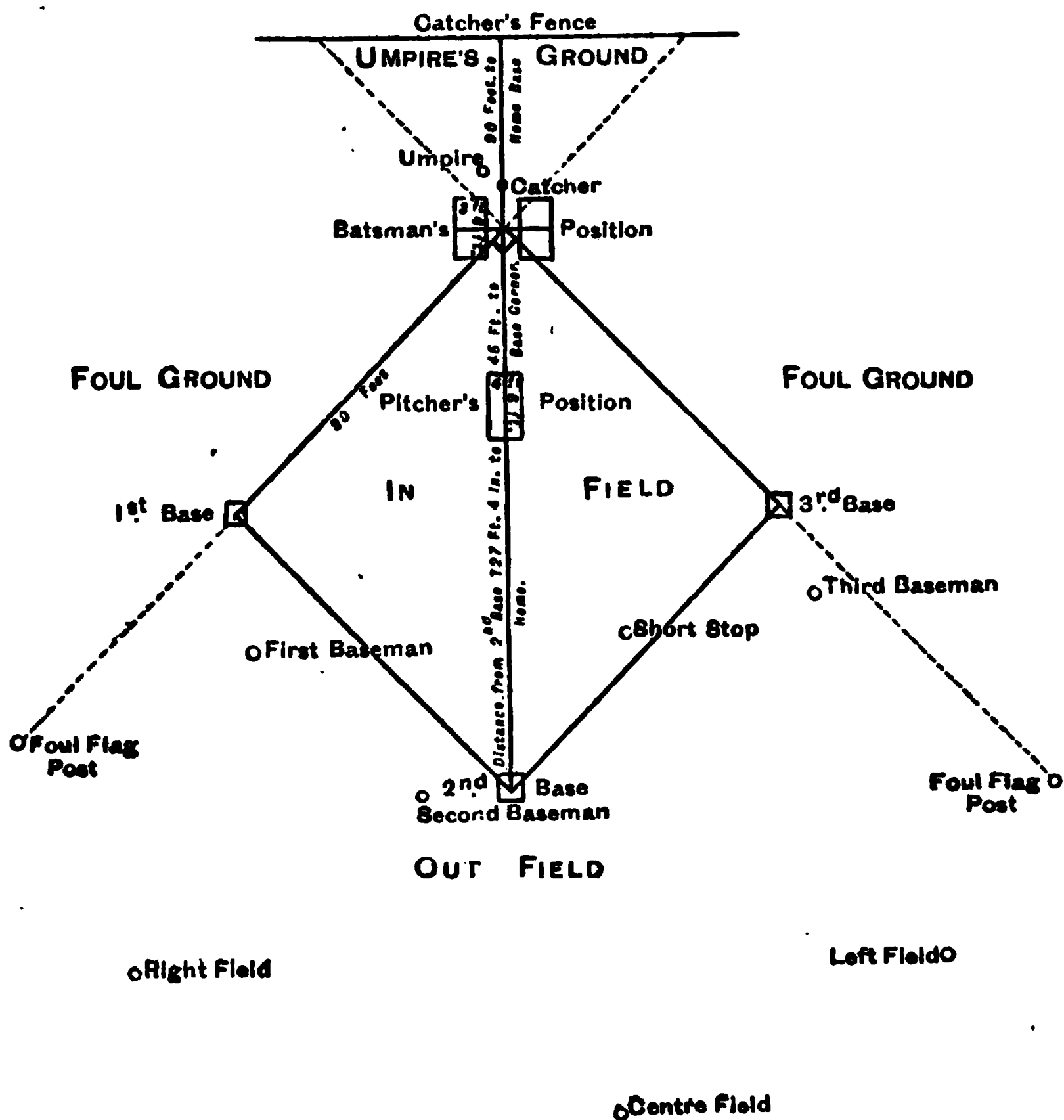


Fig. 3.—DIAGRAM OF FULL FIELD FOR BASE BALL.

is to deceive the eye of the batsman—that is, to send the ball in to the bat in such a manner as to lead the striker to believe that it is just coming in where he wants it—while, in fact, it is either too high or too low, or is too swift or too slow for the purpose. Moreover, he should have the pluck to face hot balls direct from the bat. This, indeed, is so essential, that unless he can do it without the slightest hesitation, he will never pitch with judgment, for he will be so impressed with the idea of avoiding being hit with the ball that he will think of little else.

BASE PLAYING.

To the careless looker-on at a match at Base Ball, it seems a comparatively easy task to run from one base to another; but base running is something that requires considerable "head-work" to excel in it. To know when to start and when to stop, to avoid hesitancy between bases, are as important essentials as fast running, and pluck, and nerve. There are so many things to look out for, and so little time to judge of one's movements, that it comes to be quite an art to excel in base running. In base running the rule is—the man who hesitates is lost.

Base Players.—The three positions occupied by the first, second, and third basemen require somewhat different qualifications to excel in them, though they all need certain abilities alike. The feature of the first baseman's duties is to securely hold swiftly-thrown balls; that of the second baseman is to touch players running to his base; while an important part of the third baseman's duties is to catch difficult foul balls, having a great twist given them by the bat. Moreover, he has the longest and most difficult throwing to attend to. The only place for a left-hand player on the bases is at first base.

First Baseman.—All basemen should be good ball-catchers, but the occupant of the first base should specially excel in holding the swiftest-thrown balls. He should also be fearless in facing hot balls from the bat, and expert in taking balls from the field, while holding one foot on the base. When a ball is hastily thrown to first base, his care should be to hold it, but at any rate to stop it. A good first base player ought to be able to hold a ball from the field, if it comes in anywhere within a radius of six feet from the base; and in case of high-thrown balls, he ought to take them at least eight feet high from the base. He must remember that the ball must be held by him—with some part of his person touching the base at the same time—before the striker reaches it, or the latter is not out; if the ball is held simultaneously with the striker's reaching the base the base runner is not out. When an overthrown ball to first base is stopped by the crowd in any way—accidentally or intentionally—he must first throw it to the pitcher's position before he can use it to put a player out.

Second Baseman.—The second baseman requires to be a pretty active fielder, an accurate thrower for a short distance, and a pretty sure catch; he should, however, be very expert in catching a swiftly-thrown ball, and in holding it firmly and putting it quickly on the player running to his base. He is required to cover the second base, and to play "right-short-stop," too; but his position in the field must be governed entirely by the style of batting he is called upon to face. If a strong hitter comes to the bat, and swift balls are being sent in, he should play well out in the field between right field and second base, and be on the *qui vive* for long-bound balls, or high-fly balls, which drop between the out-field and the second base line. When the batsman makes his first base the second baseman comes up and gets nearer his base, in readiness to receive the ball from the catcher. He should remember that in a majority of cases his duty is to touch the base runner, and this it would be well to do in all cases when the latter is found off his base; though, in cases of foul balls not yet returned to the pitcher, or when a ball has been stopped by the crowd, and then thrown to second before being sent to the pitcher's position, no man can be put out by being touched when off his base. The habit, however, is a good one to get into, as there is then no likelihood of its being forgotten when it becomes necessary for a player to be touched.

Third Baseman.—The third baseman's duties are the most onerous of the three positions on the bases, as on his good fielding will frequently depend the loss of runs to his opponents, when the failures on the other bases are made only

at the cost of a single base. In the case of a miss play at third base, however, one or more runs scored is generally the result—that is, in cases where players are running their bases. When no men are on the bases, the third baseman will have to be active in fielding the ball, and quick and accurate in throwing it, in order to prevent the striker from making his base. The third baseman takes a position closer to his base than either of the other basemen. Sometimes, however, he takes the place of the short-stop when the latter covers the second base in cases where the second baseman plays at right-short for a right-field hitter.

Base players should bear in mind that the life of in-field play—as of fielding generally—lies in the support afforded each other by those who are located near each other, as all the in-fielders are. A good fielder or base player never stands still; he is always on the move, ready for a spring to reach the ball, a stoop to pick it up, or a prompt movement to stop it, and he always has his eye upon the ball, especially when it is flying about inside the base lines or from base to base. Poor base players seldom put themselves out of the way to field a ball unless it comes within their special district, but a good base player is on the alert to play at a moment's notice, on any base from which the player has gone after the ball. When bases are vacated, or foul or fly-balls are struck, all the base players handle the ball in the same way as at first base, but it is advisable to make sure always by touching the player when he is off the base.

The Short Stop.—This is the position in the in-field in which the most active fielder of the nine is needed. His special work is “backing-up” his *confrères*, not only in occupying any base-player's position when the base-player goes after a ball, but also in running behind players to stop over-thrown or wide-thrown balls. He also has to attend upon the pitcher and save him from extra work in fielding balls thrown back to him from the catcher. No player is fitted to occupy this position who is not quick and lively in his movements in backing up all the positions of the in-field. When a player is on the first base and one on the third, and the catcher holds the ball ready to throw to second, the short-stop should get nearly on the line of the pitcher and second baseman, and have an understanding with the catcher to have him throw the ball to short-stop instead of second base, for on seeing the ball leave the catcher's hands apparently for second base the player on the third will be apt to leave for home, in which case the short-stop will have the ball in hand ready to throw either to the catcher or third base; by this means, though the player running to second will have his base given him, the player on the third will be likely to be put out, and the player nearest home is the party to be put out first when there is any choice.

The Out-fielders.—The occupants of the positions in the outer field, viz., left, centre, and right fields, should be equal in their qualifications as fielders. Each should be able to throw a ball 100 yards, certainly not less than eighty at least. They should be good runners and excellent judges of fly-balls. They should never stand still or occupy one position all the time, but be on the move, ready for a quick run, or to back up each other. In judging of fly-balls, it is always safer to lay out for a long hit than to get so close in as to have to get back to catch a ball. They never should hold a ball a minute, but return it to the in-field as soon as handled. The point to throw the ball in to is the pitcher's position, as a general thing, but as to that, they will have to be guided by circumstances, according as the ball sent to them is taken on the fly, or fielded while a player is running his bases. One or other of the positions in the outer field is the place for the change pitcher of the nine, as it will afford him a chance to rest. The out-fielders should watch the movements of the pitcher and catcher closely, whenever a new batsman takes his stand at the home base, in order to be ready to obey any signals either to come in or go out farther, according to the character of the pitching or the peculiar style of the batsman.

GENERAL HINTS TO PLAYERS.

There is no habit fielders have that is more characteristic of mere schoolboy play in the game, or which leads to more ill-feeling in a match, than that of openly finding fault with those who commit errors in the game. Every man on the field tries to do his best for his own credit's sake, and if he fails, censure but adds to his chagrin, without in the least improving his play; on the contrary, fault-finding is only calculated to make him play worse. In no game are the amenities of social life more necessary to a full enjoyment of the pastime than in Base Ball. Particularly acceptable to young players are words of commendation for good play, and remarks calculated to remove the annoyance arising from errors in the field, and these form some of the strongest incentives to extra exertion on their part, besides promoting kindly feelings on the field and during the game. We must enter our protest against the fault-finding, grumbling, and snarling disposition which continually censures every failure to succeed, and barely tolerates any creditable effort that does not emanate from themselves, or in which they do not participate. Such men as these constitutional grumblers are the nuisances of a ball field, and destroy all the pleasure which would otherwise result from the game. Every manly player will keep silent when he sees an error committed, or, if he makes any remarks at all, will apologise for it in some way. Those who find fault and growl at errors of play are of the class who prefer to gratify their malice and ill-temper at the expense of the unlucky fielder who happens to "muff" a ball or two in a game.

Fielders should remember that the captain of the nine is alone the spokesman of the party and the commander of the field.

No out-fielder should hold a ball a moment longer than it is necessary for him to handle it in throwing. In the in-field, however, a ball can be sometimes held by the fielder with safety and advantage.

Never stand still in your position, simply because the ball happens to go in another direction than the position you occupy, but always be on the move to aid the other fielders or to back them up. Activity in the field, and judgment in being prompt in support, is the characteristic of a first-class fielder.

Play earnestly at all times, whether in an ordinary practice game or in a match. Get into the habit of doing your best on all occasions. It is invariably the mark of a vain and conceited ball player to walk on the field and play in a game as if he were conferring a favour by participating in the game; and players who play with an air of indifference as to the result of the game, or who become despondent when the odds are against them, are no players for a first-class nine.

THE ASSOCIATION RULES OF BASE BALL.

The following are the playing rules of the game of Base Ball, as adopted by the National Association at their annual convention in February, 1880. These rules were adopted by the American College Association, and they govern all the amateur clubs in the United States. The only difference between the National Code and the League Association of Professional Clubs is that the National rules do not admit of a bound catch, and the League rules do. And the former admit of the use of the new four-sided bat, which the latter rules do not. In all other essentials the rules are the same in both Associations.

Rule I.—The Materials of the Game.

Section 1.—The ball must weigh not less than five nor more than five and one-quarter ounces avoirdupois. It must measure not less than nine, nor more than nine and one-quarter inches in circumference. It must be composed of woollen yarn, and of two horse-

hide covers, inside and outside, with yarn between said covers. It shall contain one ounce of round moulded rubber, vulcanised.

Section 2.—In all games the ball or balls played with shall be furnished by the home club, and shall become the property of the winning club.

Section 3.—When the ball becomes out of shape, or cut or ripped so as to expose the yarn, or in any way so injured as to be unfit for fair use, a new ball shall be called for by the umpire at the end of an even innings at the request of either captain. Should the ball be lost during a game, the umpire shall, at the expiration of five minutes, call for a new ball.

Section 4.—The bat must be round or four-sided, and must not exceed two and one-half inches in diameter in the widest part. It must be made wholly of wood, and shall not exceed forty-two inches in length.

Section 5.—The bases must be four in number, and they must be placed and securely fastened upon each corner of a square, the sides of which are respectively thirty yards. The bases must be so constructed and placed as to be distinctly seen by the umpire. The first, second, and third bases must cover a space equal to fifteen inches square, and the home base one square foot of surface. The first, second, and third bases shall be canvas bags painted white, and filled with some soft material. The home base shall be of white marble or stone, so fixed in the ground as to be even with the surface and wholly within the diamond. One corner of said base shall face the pitcher's position, and two sides shall form part of the foul lines.

Section 6.—The base from which the ball is struck shall be designated the home base, and must be directly opposite the second base. The first base must always be that upon the right hand, and the third base that upon the left hand side of the striker when occupying his position at the home base. In all match games, lines connecting the home and first bases, and the home and third bases, and also the lines of the striker's and pitcher's positions, shall be marked by the use of chalk or other suitable material, so as to be distinctly seen by the umpire. The line of the home base shall extend four feet on each side of the base, and shall be drawn through its centre and parallel with a line extending from first to third base. The foul lines from first and third bases to home base shall be continued as straight lines to the limits of the field, beyond and back of said home base. The triangular space thus laid off behind the home base shall be for the exclusive use of the catcher, umpire, and batsman; and no player of the side "at bat" (except the batsman) shall be permitted to occupy any portion of such triangular space.

Rule II. —The Game.

Section 1.—The game shall consist of nine innings to each side; and nine men shall constitute a full side. Should the score at the end of the nine innings be a tie, play shall be continued until a majority of runs for one side upon an equal number of innings shall be declared, when the game shall end. All innings shall be concluded when the third hand is put out.

Section 2.—The home club shall first take the bat. The fielders of each club shall take any position in the field their captain may assign them, with the exception of pitcher, who must deliver the ball from his appointed position.

[The exception made in the above rule in the case of the pitcher refers only to the fact that whichever player in the field he may select to take the regular pitcher's position, such changed pitcher must deliver the ball only from the regular position. It does not prevent a change of pitchers, but only requires that the ball in all cases must be sent in from the regularly appointed position.]

Section 3.—No player taking part in a game shall be replaced by another after the commencement of the second innings, except for reason of illness or injury.

Section 4.—No game shall be considered as played unless five innings on each side shall be completed. Should darkness or rain intervene before the third hand is put out in the closing part of the fifth innings of a game, the umpire shall declare "no game."

Section 5.—Should rain commence to fall during the progress of a match game, the umpire must note the time it began; and should it continue for five minutes he shall, at the request of either captain, suspend play. Should the rain continue to fall for thirty minutes after play has been suspended, the game shall terminate.

Section 6.—When the umpire calls "play," the game must at once be proceeded with. Should either party fail to take their appointed positions in the game, or to commence play as requested, the umpire shall, at the expiration of five minutes, declare the game forfeited by the nine that refuses to play. When the umpire calls "time," play shall be suspended until he calls "play" again, and during the interim no player shall be put out, base be run, or run be scored. The umpire shall suspend play only for illness or an accident or injury to himself or a player, or on account of rain or lost ball.

Section 7.—The umpire, in any match game, shall, in case of rain or darkness, determine when play shall be suspended; and, if the game cannot be fairly concluded, it shall be decided by the score of the last even innings played, unless one nine shall have completed their innings, and the other nine shall have *equalled* or exceeded the score of their opponents in their incompleated innings, in which case the game shall be decided by the total score obtained, which score shall be recorded as the score of the game.

Section 8.—When the side last at the bat in the ninth or any subsequent innings shall score the winning run, the game shall terminate.

[The cases in which Section 7 of the rule applies are as follows:—If the A nine have played their sixth innings—or any other following innings—and have scored one run in their six or more innings' play, and the B nine in their sixth innings score a single run before a hand is put out, and the umpire "calls" or ends the game for any legal cause, in such case the game terminates in a drawn match. If under similar conditions the nine, in their incompleated sixth innings, score two runs, thereby exceeding their adversary's score, and the game then and there ends by the umpire's decision, the nine having the largest score wins. It is the umpire, and he only, who decides when a game shall end, of course with the exception of the case of full innings being played with one nine having a majority of runs.]

Section 9.—When the umpire calls "game" it shall end; but when he merely suspends play for any stated period, it may be resumed at the point at which it was suspended, provided such suspension does not extend beyond the day of the match.

[There are no circumstances known to the rules which admit of a contesting nine legally refusing to continue play in a match after having commenced the game. When the umpire has been mutually agreed upon and the contest proceeded with, it must be played to a close by both parties under the penalty of forfeiture by the side refusing to play.]

Rule III.—The Pitching Department.

Section 1.—The pitcher's position shall be within a space of ground four feet wide by six feet long, the front, or four feet line, of which shall be distant forty-five feet from the centre of the home base, and the centre of the square shall be equi-distant from the first and the third bases. Each corner of the square shall be marked by a flat iron plate or stone, six inches square, fixed in the ground even with the surface.

Section 2.—The player who delivers the ball to the bat must do so while wholly within the lines of the pitcher's position. He must remain within them until the ball has left his hand, and he shall not make any motion to deliver the ball to the bat while any part of his person is outside the lines of the pitcher's position. The ball must be delivered to the bat with the arm swinging nearly perpendicular at the side of the body, and the hand in swinging forward must pass below the hip. The pitcher, when taking his position to deliver the ball, must face the batsman, and shall not, while delivering the ball, turn his back to the striker.

Section 3.—Should the pitcher deliver the ball by an overhand throw, a "foul baulk" shall be declared. Any outward swing of the arm, or any other swing save that of the perpendicular movement referred to in Section 2 of this rule, shall be considered an overhand throw.

Section 4.—When a "foul baulk" is called, the umpire shall warn the pitcher of the penalty incurred by such unfair delivery; and should such delivery be continued until *three foul baulks* have been called in one innings, or six in the entire game, the umpire shall declare the game forfeited.

Section 5.—Should the pitcher make any motion to deliver the ball to the bat, and fail so to deliver it—except the ball be accidentally dropped—or should he unnecessarily delay the game by not delivering the ball to the bat, or should he, when in the act of delivering the ball, overstep the bounds of his position, the umpire shall call a "baulk," and players occupying the bases shall take one base each.

Section 6.—Every ball fairly delivered and sent in to the bat over the home base and at the height called for by the batsman shall be considered a good ball.

Section 7.—All balls delivered to the bat which are not sent in over the home base and at the height called for by the batsman shall be considered unfair balls, and every ball so delivered must be called. When "eight balls" have been called, the striker shall take first base, and all players who are thereby forced to leave a base shall take one base. Neither a "ball" nor a "strike" shall be called until the ball has passed the home base.

Section 8.—All balls delivered to the bat which shall touch the striker's bat without being struck at, or his (the batsman's) person while standing in his position, or which shall hit the person of the umpire—unless they be passed balls—shall be considered *dead* balls, and shall be so called by the umpire; and no players shall be put out, base be run, or run be scored on any such ball; but if a dead ball be also an unfair ball, it shall be counted as one of the eight unfair balls which shall entitle the striker to a base.

[The ball may be *tossed* in—as in the case of a square pitch—or it may be sent in by a *jerk*, or an *underhand throw*, either method of delivery being legal under this rule, provided the ball, in the forward swing, passes “below the waist.” In all cases where the ball is sent in on a line with the waist the umpire must promptly call “foul baulk.”]

Rule IV.—The Batting Department.

Section 1.—The batsman's or striker's position shall be within a space of ground located on either side of the home base, six feet long by three feet wide, extending three feet in front of, and three feet behind, the line of the home base, and with its nearest line distant one foot from the home base.

Section 2.—The batsmen must take their position in the order in which they are directed by the captain of their club; and after each player has had one time at the bat, the striking order thus established shall not be changed during the game. After the first innings the first striker in each innings shall be the batsman whose name follows that of the last man who has completed his turn (time) at the bat in the preceding innings.

Section 3.—Any batsman failing to take his position at the bat in his order of striking—unless by reason of illness or injury, or by consent of the captains of the contesting nines—shall be declared out, unless the error be discovered before a fair ball has been struck or the striker been put out.

Section 4.—Any batsman failing to take his position at the bat within *one minute* after the umpire has called for the striker shall be declared out.

Section 5.—The batsman on taking his position must call for either a “*high ball*,” a “*low ball*,” or a “*fair ball*,” and the umpire shall notify the pitcher to deliver the ball as required; such call shall not be changed after the first ball delivered.

Section 6.—A “*high ball*” shall be sent in above the belt of the batsman, but not higher than his shoulder. A “*low ball*” shall be one sent in at the height of the belt, or between that height and the knee, but not higher than his belt. A “*fair ball*” shall be one between the range of shoulder high and the knee of the striker. All the above must be over the home base, and, when fairly delivered, shall be considered fair balls to the bat.

Section 7.—Should the batsman fail to strike at the ball he calls for, or should he strike at and fail to hit the ball, the umpire shall call “one strike,” and “two strikes” should he again fail. When two strikes have been called, should the batsman not strike at the next “good ball,” the umpire shall warn him by calling “good ball.” But should he strike at and fail to hit the ball, or should he fail to strike at or hit the next good ball, “three strikes” must be called, and the batsman must run towards the first base, as in the case of hitting a fair ball.

[The meaning of the above section is as follows:—Suppose the first ball sent to the bat should be over the home base and at the height called for, and the batsman is not prepared to strike at it, or refuses to do so, it is then the duty of the umpire to call “one strike.” If the second ball sent in is similarly fair, and not struck at, “two strikes” must be called, and should the third such ball sent in be struck at and not hit, in such case “three strikes” must be called. Now suppose two fair balls are again sent in, and the batsman strike at them and fail to hit them, “one strike” and then “two strikes” must be called as before. But in such case, if the third ball sent in fair be not struck at, then the umpire warns the batsman by exclaiming, “fair ball,” and then if the fourth ball be not struck at, or, if struck at, be not hit, the umpire calls “three strikes; striker out.”]

Section 8.—The batsman, when in the act of striking at the ball, must stand wholly within the lines of his position.

Section 9.—Should the batsman step outside the lines of his position when he strikes at the ball, the umpire shall call “foul strike and out,” and base runners shall return to the bases they occupied when the ball was struck at or hit.

Section 10.—The foul lines shall be unlimited in length, and shall run from the right and left hand corners of the home base, through the centre of the first and third bases to the foul posts, which shall be located at the boundary of the field, and within the range of home and first base, and home and third base. Said lines shall be marked, and on the inside, from base to base with chalk, or some other white substance, so as to be plainly seen by the umpire.

Section 11.—If the ball from a fair stroke of the bat first touches the ground, the person of a player, or any other object, either in front of or on the foul ball lines, or the first or third base, it shall be considered fair. If the ball, from a fair stroke of the bat, first touches the ground, the person of a player, or any other object behind the foul ball lines, it shall be declared foul, and the ball so hit shall be called foul by the umpire, even before touching the ground, if it be seen falling foul.

The following are exceptions to the foregoing sections :—All balls batted directly to the ground that bound or roll within the foul lines between home and first, or home and third bases, without first touching the person of a player, shall be considered fair. All balls batted directly to the ground that bound or roll outside the foul lines between home and first, or home and third bases, without first touching the person of a player, shall be considered foul. In either of these cases the first point of contact between the batted ball and the ground shall not be regarded. If a batted ball strikes the batsman while standing in his position, it shall be declared dead, and not in play until settled in the hands of the pitcher, and the batsman shall not be declared out.

Section 12.—When the batsman has fairly struck a ball he shall vacate his position, and he shall then be considered a base-runner until he is put out or scores his run.

Section 13.—The batsman shall be declared out by the umpire as follows :—

If a fair or foul ball be caught before touching the ground, or any object other than the player, provided it be not caught in the player's hat or cap.

If a foul ball be similarly held, before touching the ground.

If a fair ball be securely held by a fielder while touching the first base with any part of his person before base-runner touches said base.

If, after three strikes have been called, he fails to touch first base before the ball is legally held there.

If, after three strikes have been called, the ball be caught before touching the ground.

If he plainly attempts to hinder the catcher from catching the ball, evidently without effort to make a fair strike, or makes a "foul strike."

[In reference to putting out base-runners from home base at first base, the umpire must bear in mind the fact that the rule, by letter as well as spirit, requires that the ball be held by the base-player *before* the base-runner reaches the base, in order to put him out. If it be held simultaneously with his touching the base, then the runner is not out.]

Rule V.—Running the Bases.

Section 1.—Players running bases must touch each base in regular order, viz., first, second, third, and home bases; and when obliged to return to bases they have occupied, they must retouch them in reverse order, both when running on fair and foul balls. In the latter case the base-runner must return to the base where he belongs, on the run and not at a walk. No base shall be considered as having been occupied or held until it has been touched.

Section 2.—No player running the bases shall be forced to vacate the base he occupies, unless the batsman becomes a base-runner. Should the first base be occupied by a base-runner when a fair ball is struck, the base-runner shall cease to be entitled to hold said base until the player running to first base shall be put out. The same rule shall apply in the case of the occupancy of the other bases under similar circumstances. No base-runner shall be forced to vacate the base he occupies if the base-runner succeeding him is not thus obliged to vacate his base.

[The rule limits a base runner's being forced off to the act of the batsman in running to first base. For instance, if all three of the bases be occupied when the batsman makes a fair hit, then the moment such hit is made all three of the base-runners cease to be entitled to hold the bases they then occupy, inasmuch as the base-runner from home to first base forces the runner on first to vacate, he on the first forces the runner on second, and he on the second forces the runner on the third. But if there are runners on first and third bases only, and the runner on first is forced to vacate that base by the batsman, the runner on third is not thereby forced to vacate that base by the runner forced to leave first. If a base-runner on third base leaves his base to run home, and in the interim a runner on second occupies third base—if the former, finding he cannot reach home safely, runs back to third, the occupant of third from second base must return to second, he having no right to hold third base until the regular occupant of that base, who preceded him, touches the next base.]

Section 3.—Players forced to vacate their bases may be put out by any fielders in the same manner as when running to first base.

Section 4.—The player running to the first base shall be at liberty to overrun said base without his being put out for being off the base, after first touching it, provided that in so overrunning the base he make no attempt to run to second base. In such case he must return at once and retouch first base, and after retouching said base he can be put out as at any other base. If, in so overrunning first base, he also attempts to run to second base, he shall forfeit such exemption from being put out.

Section 5.—Any player running a base who shall run beyond three feet from the line from base to base, in order to avoid being touched by the ball in the hands of a fielder, shall be declared out by the umpire, with or without appeal; but in case a fielder be occupying

the runner's proper path, attempting to field a batted ball, then the runner shall run out of the path and behind said fielder, and shall not be declared out for so doing.

Section 6.—One run shall be scored every time a base-runner, after having regularly touched the first three bases, shall touch the home base before three hands are out, and players shall score in the order of going to the bat, unless previously put out. If the third hand is forced out, or is put out before reaching first base, a run shall not be scored.

Section 7.—When a "balk" is called by the umpire, every player running the bases shall take one base without being put out, and shall do so on the run.

[There is quite a difference between taking bases on "balks" and taking them on "called balls." In taking bases on balls, only those occupying bases who are forced off by the giving of the base on called balls can take bases; but in the case of balks every occupant of a base, whether forced off or not, takes a base. Thus, if the first and third bases be occupied when the striker is given his base on balls, only the runner on first base can take a base; but in the case of a balk, then both the occupants of the bases take a base. Of course the batsman does not take a base on a balk.]

Section 8.—When "eight balls" have been called by the umpire the batsman shall take one base, provided he do so on the run, without being put out, and should any base-runner be forced thereby to vacate his base he shall also take one base. Each base-runner thus given a base shall be at liberty to run to other bases besides the base given, but only at the risk of being put out in so running.

Section 9.—A base-runner shall be considered as holding a base, viz., entitled to occupy it, until he shall have regularly touched the next base in order.

[A base is regarded by the rules as being occupied or held if the base-runner has not touched the next base legally. Thus, if a runner be on first base and one on second, and the latter, thinking he can steal safely to third, runs there—the runner on first base in the interim running to second and standing on second—he can return to second at his option, provided he does not first touch third base—that base at the time not being occupied or held. In such case the runner who has touched second must vacate it and return to first, as he was not entitled to hold second until the runner on second had touched third, the latter, at the time, having a right to remain on third.]

Section 10.—No base shall be run or run be scored when a fair or foul ball has been caught or momentarily held before touching the ground, unless the base held, when the ball was hit, is retouched by the base-runner after the ball has been so caught or held by the fielder.

Section 11.—No run or base can be made upon a foul ball that shall touch the ground before being caught or held by a fielder, and any player running bases shall return, without being put out, to the base he occupied when the ball was struck, and remain on such base until the ball is held by the pitcher.

Section 12.—Any player running the bases on fair or foul balls, caught before touching the ground, must return to the base he occupied before the ball was struck, and retouch such base before attempting to make another or score a run, and said player shall be liable to be put out in so returning, as in the case of running to first base when a fair ball is hit and not caught flying.

Section 13.—If the player running the bases is prevented from making a base by the obstruction of an adversary, he shall be entitled to that base, and shall not be put out.

Section 14.—No player shall be allowed a substitute in running the bases, except for illness or injury incurred in the game then being played; and such substitute shall take such ill or injured player's place only after he reaches first base. The opposing captain shall select the man to run as substitute.

Section 15.—Any player running the bases shall be declared out if, at any time, while the ball is in play, he is touched by the ball in the hand of a fielder, without some part of his person is touching a base. The ball must be held by the player after touching the runner.

If a ball be held by a fielder on the first base before the base runner, after hitting a fair ball, touches that base, he shall be declared out.

If a base runner shall have touched the base he is running for before being touched with the ball in the hands of a fielder, and such base shall break from its fastening, he shall be entitled to such base.

Any base runner failing to touch the base he runs for shall be declared out if the ball be held by a fielder, while touching said base, before the base runner returns and touches it.

Any base runner who shall in any way interfere with or obstruct a fielder while attempting to catch a fair fly-ball, or a foul ball, shall be declared out. If he wilfully obstructs a fielder from fielding a ball he shall be declared out, and, if a batted fair ball strike him, he shall be declared out.

If a base runner, in running from home to first base, shall run inside the foul line, or more than three feet outside of it, he shall be declared out.

Rule VI.—The Umpire and his Duties.

Section 1.—The umpire shall be chosen by the captains or officers of the two contesting clubs, and he shall determine all disputes and differences between the contesting players which may occur during the game.

Section 2.—The umpire in a match shall be the sole judge of fair and unfair play, and there shall be no appeal from his decision, except through the Judiciary Committee of the National Association of Professional Players.

[This is the fundamental rule of umpiring. "*The umpire is the sole judge.*" He only can decide upon any disputed point, and in every case, except when the *printed* rules of the game are plainly misinterpreted, his decision must be abided by, and should be silently acquiesced in. There is only one court of appeal from his decision on any case occurring in the progress of a match, and that is to the Judiciary Committee, and that appeal must be sent in duly attested in writing, and within a certain specified period. By this section the umpire is empowered to render a decision on every point of play, whether specially referred to in the rules or not; he applying the rule of equity in the case of the absence of any printed rule contained in the code of laws of the game bearing upon the point.]

Section 3.—The umpire shall not be changed during the progress of a match game, except for reason of illness or injury, or by the consent of the captains of the two contesting nines, in case he shall have wilfully violated the rules of the game.

Section 4.—Before the commencement of a match, the umpire shall see that the rules governing the materials of the game, and also those applicable to the positions of batsmen and pitcher, are strictly observed. Also that the fence in the rear of the catcher's position is distant not less than ninety feet from the home base, except it mark the boundary line of the field, in which case the umpire, for every ball passing the catcher and touching the fence, shall give each base runner one base without his being put out.

Before calling "play," the umpire shall ask the captain of the home club whether there are any special ground rules to be enforced, and if there are, he shall see that they are duly enforced, provided they do not conflict with any rules of the game.

Section 5.—No decision rendered by the umpire on any point of play in base running shall be reversed upon the testimony of any of the players. But if it shall be shown by the captain of either of the contesting clubs that the umpire has palpably misinterpreted the rules, or given an erroneous decision, he shall reverse said decision.

Section 6.—No person not engaged in the game shall be permitted to occupy any position within the lines of the field of contest, or in any way interrupt the umpire during the progress of the game. No player except the captain or player expressly designated by him shall address the umpire concerning any point of play in dispute, and any violation of this rule shall subject the offender to an immediate reprimand by the umpire.

Section 7.—The umpire shall require the players on the batting side who are not at the bat or running the bases to keep at a distance of not less than fifty feet from the line of home and first base and home and third base, or farther off, if he so decide. The captain and one assistant only shall be permitted to coach players running the bases, and they must not approach within fifteen feet of the foul lines.

Section 8.—Should any fielder stop or catch the ball with his hat, cap, or any part of his dress, the umpire shall call "dead ball," and the base runners shall each be entitled to two bases for any fair-hit ball so stopped or caught. Should the ball be stopped by any person not engaged in the game, the umpire must call "dead ball," and players running bases at the time shall be entitled to the bases they were running for, and the ball be regarded as dead until settled in the hands of the pitcher while standing within the lines of his position, and the player at the bat shall vacate the position and not obstruct the catcher when a ball is returned from the field for the purpose of putting out a player at the home base.

Section 9.—Any match game in which the umpire shall declare any section of this code of rules to have been wilfully violated shall at once be declared by him to have been forfeited by the club at fault.

To show the difference—merely as a matter of interest—between Base Ball, requiring such an elaborate code of rules, and Rounders, the description of the latter game in another part of this work should be read. It ought, however, to be said, that no one knowing anything of either would presume to place the extremely simple Rounders on the same footing as the more inspiring and intricate Base Ball—a game that, not only in virtue of its being the national game of the United States, but on its own merits, thoroughly justifies the high estimation in which it is held.

FENCING.

OUT-DOOR exercises are the best as a general rule, but the weather does not always admit of them. Of in-door games, tennis and racquets stand very high; but it is seldom that one lives near a court—it is a great chance if it is disengaged, if one does—and the expense is considerable. Now any barn, out-house, or unfurnished room will do for fencing, which is, after all, the finest exercise in the world; for it is the only one I know of that brings every muscle in the body equally and impartially into play, while the skill required makes it extremely interesting. The hand and eye learn to act together more rapidly than in any other practice, so that the cricketer who had fenced all the winter would be astonished to find how much smarter he had grown during the months that his bat was lying idle in the corner.

But mind this: fencing is the most stupid amusement in the world if it is not practised properly. Two fellows standing opposite, and poking at each other with foils, would soon get tired of the operation; or, if they did not, they might keep on at it for six hours a day all their lives, and never improve a little bit. Nay, they would probably incapacitate themselves from ever learning to fence at all, such bad habits would they acquire.

The first steps in learning anything are bound to be tedious; a grammar book is never lively reading. But unless you will mug a bit at grammar you will never learn the language properly, and if you slur over the rudiments of fencing you will never do any good at it. And even after you have attained a certain proficiency, it is very necessary to be careful how you indulge in loose play,

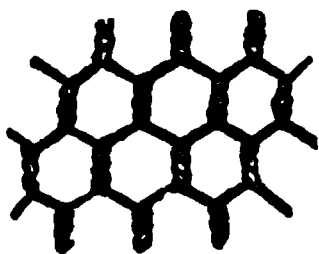


Fig. 1. — HEXAGONAL MESH FOR MASKS.

especially with opponents inferior to yourself, or your hand will soon lose its cunning, and it will take a strict course of longing to get it in again.

Now, I do not mean to tell you that you can learn to fence as well from a book as you can by the personal instruction of a good master; but good masters are not always to be had, and many drill-sergeants who profess to teach fencing know nothing at all about it. And I will say that if you *carefully* follow the instructions here given, you will make much better progress than by picking up the faults of a gymnast who finds it necessary to profess to teach an art of which he is entirely ignorant, in addition to those exercises which are his peculiar province.

Only, you must be a little patient and attentive. I on my part will be as clear in my descriptions as I can, if you on yours will try to understand them by comparing them with the diagrams, and taking pains to place yourself in the correct attitudes.

Before we begin our instructions, a few hints about equipment may be useful.

Health and comfort will be promoted by wearing a flannel shirt and trousers under the defensive clothing, which must consist of mask, jacket, glove with gauntlet, and thigh-piece or apron. The masks must be made on the French plan of twisting the wire, so as to form an hexagonal mesh (Fig. 1). English wire-work is unsafe, as the broken end of a foil would stab through it (Fig. 2).

The German foil blades that are imported from Solingen marked "King's Head" have the oldest reputations, but they are so generally imitated that it

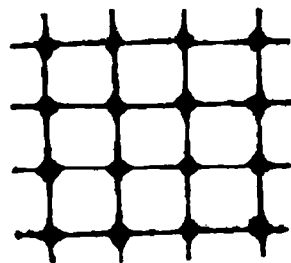


Fig. 2.—UNSAFE WIRE-WORK FOR MASKS.

is difficult to make sure of getting them. They generally sell terrible rubbish at the toy-shops. If you join a Fencing School or Club, of course the master will provide you with everything; it is his perquisite. For the jacket, some men prefer soft leather, lined and padded; others choose a leather which is stouter and stiffer, and requires no lining; but, however it is made, it must be high and stiff in the collar, to guard the neck (Fig. 3).

The glove must be nicely stuffed at the back of the fingers, and the thumb end well covered, to protect the nail in case of a jar; the palm of very soft pliable leather, so as not to interfere with the grip of the sword hilt; the gauntlet long enough to guard the wrist.

If you were certain never to meet any but cool, careful, and skilful fencers, all defensive clothing might cease at the waist, but as such a state of affairs exists only in Utopia, and we have not got there yet, you should wear a thigh-piece, strapped round the middle

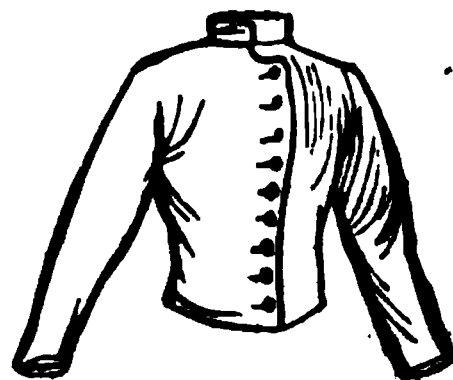


Fig. 3.—FENCING JACKET.

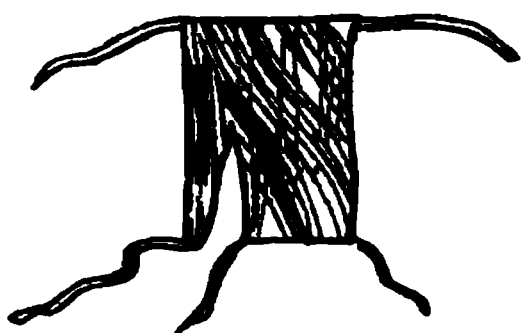


Fig. 4.—THIGH-PIECE.

pass between the legs, kept in its place by a third strap fastening it to the waist behind (Fig. 4). Or, if you prefer it, a leather apron will answer the same purpose. The instructor, having to receive the perpetual longes of his pupils, must wear a thickly-padded breastplate called a *plastron*; this sometimes has a little heart of red cloth sewn on in the centre, to direct the thrusts.

The shoes should be soft and pliable, but we do not recommend india-rubber soles, which heat the feet. Some fencers like to have a broad flap spreading beyond and on both sides of the right shoe, while others cannot see any advantage in it; taste and toes differ.

The great matter is to feel easy and comfortable, and not to wear anything which cramps the free play of the limbs or impedes the circulation.

We cannot too strongly urge you never to fence with any one who is not properly protected, with mask and jacket at any rate. In a school, indeed, it is seldom or ever that you will find any one inclined to neglect such a natural precaution, but sometimes, in a private room, or the hall of a country house, you may meet one, a tyro most probably in the art, who will propose a bout at fencing, and simply pull his coat off.

Refuse to cross foils with him unless he will put on something more efficiently defensive than shirt-sleeves. It is all very well for him to run the risk of being hurt if he chooses, but he has no right to put you in the way of incurring the danger of hurting him.

There is nothing more distressing than to inflict an injury on a friend while mutually engaged in sport; and, indeed, when such accidents occur, the one who is injured may generally be considered to have the best of it.

When a foil becomes bent, it may be readily straightened again by laying it on the ground, placing your foot upon it, and drawing it upwards in the opposite direction.

The foil is a quadrangular blade; it should measure thirty-four inches from point to hilt. The most esteemed foil blades, as we have already seen, are manufactured at Solingen, and bear that name.

Beware of the flat blades, flexible as a riding-whip, sold in some toy-shops.

The handle should be seven inches long, almost square, slightly curved, of uniform size throughout, and should be covered with twisted twine of two sizes;

the pommel not too large, and just heavy enough to balance the blade when placed on the forefinger between two and three inches from the guard.

The best hilt is the ordinary open iron one, but both sides should be bent upwards, to protect the thumb and fingers from injury, and should also have a piece of strong leather or buffalo hide on the side next the handle.

The button on the point is sometimes covered with a bit of cardboard, with wash-leather tied over it, but gutta-percha will be found more convenient. Take a small square of that substance, warm the point, and mould the gutta-percha over it.

COST OF IMPLEMENTS.

Best Solingen ("King's Head") or English foil-blades, are 24s. the dozen; pommels and guards, 6s. the dozen; foils complete, from 3s. 6d. to 6s. each; gloves, from 5s. 6d. to 12s.; fencing masks (French pattern; don't have the cheap English masks at any price), 9s. 6d. to 15s.; stick masks (about which you need not be so particular), 19s.; single-sticks, 4s. the dozen; buffalo-hilts, 7s. each; jackets, from 14s. to 80s.; thigh-protectors, 14s. 6d.; plastrons, 6s. 6d. to 15s.; spring practice bayonets, 58s. or 70s.

Of course these figures are approximate only; if a club imports its own implements it may get them cheaper. Our own experience, however, makes us confident about *this*, that the most economical plan is to get the very best articles in the first instance.

The object of him who desires to become a good swordsman must be to combine with perfect coolness the greatest possible rapidity of movement, with firmness on the legs, and suppleness of body; to parry without effort, and yet effectively; to feint with safety.

Five qualities are necessary for the attainment of this ideal: knowledge, precision, rapidity, a quick eye, and a strong wrist. The first three are only to be acquired by careful practice of the rudiments before loose practice is indulged in. Let us therefore begin with

Fig. 5.
CORRECT ATTITUDE—
FIRST POSITION.

THE POSITION.

If attitude is not "everything" in fencing, it is at least a very great deal, for without securing a correct position, into which the learner shall fall instinctively, without thinking about it, further progress is impossible. The more pains he takes to come on guard and longe correctly the quicker will he get on afterwards.

Place yourself with your right breast opposite the adversary, your eyes fixed on his, your right foot pointing to the front, the left to the left, at right angles; the right heel in front of the left ankle; the body upright; the hips rather drawn back, but without constraint; the head erect, but not thrown back; the hands hanging easily at the sides, the left holding the foil as if it were a sword in its scabbard, convex side of the handle upwards (Fig. 5).

Raise the right hand in front of the body as high as the face, palm upwards, and bring it across to the hilt of the foil, which grasp lightly. Raise both hands above the head, separating them, so that the left hand shall hold the point of the foil (Fig. 6).

Fig. 6.
CORRECT ATTITUDE
—SECOND POSITION.

Bring down the right arm with the foil, until the elbow is about on a level with the waist, and some eight inches in front of it; thumb along the surface of the hilt; forefinger under the thumb; the point of the foil as high as the chin; the fore-arm and foil in a straight line. The left arm must remain in the position in which it held the point above the head, except that the palm of the hand is to be turned to the front. Then, without moving the body, head, or neck, bend both knees, sinking down as low as you can, and advance the right foot some twelve or fourteen inches, so that the leg from the knee to the ground is perpendicular (Fig. 7). Now you are on guard, which is the position from which all attacks are made, and in which all attacks are parried. Short men should have their guard as high as their necks, men of middle height a little above the middle of the chest; tall men should take the middle exactly. As a rule, you must always regulate the height of your guard by that of your adversary.

Fig. 7. CORRECT ATTITUDE—
"ON GUARD."



Fig. 8.—HOW TO HOLD THE FOIL.

(Fig. 8). The foil then must be held firmly, but not grasped hard; the thumb advanced along the upper side of the hilt, and nearly touching the shell; the forefinger exactly underneath it; the other fingers close up to the forefinger, not separated.

Remember also with regard to the feet, that in all positions, whether you advance, retire, or lunge, they must remain as they are placed when on guard, i.e., at right angles, the right foot pointing to the front, the left to the left; for if the toes are turned outwards or inwards the body will at once lose its balance, while in the case of lunging, your point will be turned aside from the adversary's breast.

The Advance.—Take a short quick pace to the front with the right foot, which must not be raised high, but just skim the ground. As the right foot touches, bring up the left the same distance, taking care to keep the feet in their relative positions, i.e., at right angles, and the right heel on a line with the left ankle.

Fig. 9.—THE LUNGE.

The Retreat.—Take a short quick pace to the rear with the left foot, and as it touches the ground bring back the right foot, planting it firmly on the ground.

The Lunge.—Straighten the right arm raising the hand, and depressing the point of the foil, until arm and foil form one horizontal line; and as you do this

turn the nails upwards. Then step forward from fifteen to eighteen inches with the right foot, and straighten the left leg by pressing back the knee, taking care not to move the left foot, which must be kept flat and firmly planted: at the same time let the left hand fall to within a few inches of the thigh (Fig. 9).

After a little practice, these actions are performed simultaneously, but it is of such vital importance that the nails should be turned upwards (Fig. 10)—a slight movement which gives strength and suppleness to the wrist, while it communi-



Fig. 10.—POSITION OF THE HAND IN LONGEING.

first straighten the arm, then longe. It is well to have a mark on the adversary's plastron to aim your point at; or for private practice, make a mark on a wall at the height of the centre of a man's breast, and longe at that. You cannot take too much pains to acquire the habit of performing this movement properly; for if you once get in the way of plunging forwards with a bent arm, and making a poke, you will find it very difficult to break yourself of it. You would never have the opportunity of doing so if you were opposite a weapon with a point to it. On the first occasion of the experiment, your adversary would merely hold his sword straight, and you would plunge upon it.

Pay great attention to the position of the body when extended: see that the feet remain at right angles; that the right leg is perpendicular from the knee to the ankle—if the foot is beyond the perpendicular line, you have "longed" too far—that the head and shoulders are not bent forward, but retain the same position as when on guard.

The lowering of the left arm is of use in preserving the balance.

To *recover* from the extended position, press the ground with the right foot, springing back to the position of the guard, re-bending the left knee, and tossing up the left hand again. These are the movements which may be considered as having reference to the *position* in fencing.

That half of the foil which is nearest the handle is called the *forte*, the other half the *faible*.

Constantly to oppose the forte of your own blade to the faible of your enemy's is one of the secrets of fencing. Therefore you should try to keep your wrist raised a little above that of your adversary, so as to dominate his, in the upper lines; in the lower lines, keep your wrist a little lower than his.

The *Line* is the direction which the foil should take either for attack or defence, pointing to the opponent's body, not his extremities.

The *Defence*.—Pupil and instructor are on guard opposite to one another at longeing distance; the blades of their foils joined on the inner line, touching but not pressing one another.

The best and clearest description of the lines of defence is afforded by the diagram, with explanations, given by Captain Chapman in his excellent little work on foil practice, which we cannot do better, with his kind permission, than reproduce here (Fig. 13).

A swordsman presenting his point to the front, either defensively or offensively, may be himself attacked in one of the following four directions, termed the lines of defence:—

On the left of his sword-hand beneath the hilt	...	...	The low inside line.
On the right of his sword-hand beneath the hilt	...	...	The low outside line.
On the right of his sword-hand above the hilt	...	...	The high outside line.
On the left of his sword-hand above the hilt	...	...	The high inside line.

It will thus be seen that, with a sword of ordinary length, one only of these lines can be defended at a time, and consequently the three other lines must remain open to attack.

For the defence of each line there are two parries (*see* Fig. 13); the sword in both parries being placed in a similar direction, the parries themselves differing only in the position of the sword's edge, the sword-hand being held in the one case in supination (the nails turned upwards), and in the other in pronation (the nails turned downwards). These eight parries are called:—

- | | |
|-------------|------------------------------|
| 1. Prime. | 5. Quinte. |
| 2. Seconde. | 6. Sixte. |
| 3. Tierce. | 7. Septime (or half-circle). |
| 4. Quarte. | 8. Octave. |

The allotment of these eight parries to the four lines of defence is thus:—

From the centre of the breast, and with the elbow moderately bent.

- | | | |
|--|---|--|
| 1. Prime
and
7. Septime
(or half-circle). | { The hand tending to the left, the point lowered and inclined to the left, the nails turned down.
The same, but with the nails turned up and the arm elongated. | { Parry the attack directed on the inside low. |
| 2. Seconde
and
8. Octave. | { The hand tending to the right, the arm straightened, the point lowered and inclined to the right, the nails turned down.
The same, but with the nails turned up. | { Parry the attack directed on the outside low. |
| 3. Tierce
and
6. Sixte. | { The hand tending to the right, the point raised and inclined to the right, the finger nails turned down.
The same, but with the nails turned up. | { Parry the attack directed on the outside high. |
| 4. Quarte
and
5. Quinte. | { The hand tending to the left, the point raised (slightly).
The same, but with the nails turned down. | { Parry the attack directed on the inside high. |

These parries are effected with the forte of the blade upon the adversary's faible, either by a sharp beat or a simple pressure.

Observe that in each of the two parries which may be employed to meet the same attack, the foil blade follows the same line, so that the point is in exactly the same spot when the movement is completed, the difference lying in the position of the wrist, arm, and elbow, caused by turning the nails up or down.

The question then may be asked, why this complication? Why not simply teach four parries to meet the four attacks?

Because the parry should always be formed with the view to riposting, or attacking immediately the adversary's blade is turned aside, and this is most readily and effectively done, sometimes with the hand in supination, at others in pronation. Thus, the double parry gives scope for the attainment of that most desirable object in fencing, variation in the attack.

There is also another object in having these two parries for each thrust, which is not apparent in the use of the foil, and need not be more than summarily alluded to. Fencing is adapted to the use of swords of different form, and when your weapon is of the two-edged description, such as a rapier, it is requisite to avoid parrying with the flat of the blade.

Fig. 11.—TIERCE.



FIG. 12.—QUARTE.

Crossing swords with your opponent is termed the *engagement*; when in attacking you he shifts his blade into a new line, as from the inside to the outside, or *vice versa*, he *disengages*. In the engagement the sword should be held securely, but without strain; at the moment of parrying the hold should be tightened.

Simple parries are those which are made when, on the adversary's disengagement, your point is passed in direct course either from tierce to quarte, or quarte to tierce (high lines); septime to seconde, seconde to septime (low lines); or when the point is raised and lowered from the high to the low, or from the low to the high lines on the *same* side, *e.g.*, from quarte to septime, septime to quarte. Thus the simple parries always throw off the attack in the line in which it is directed.

Counter-parries are when the sword-hand, in parrying a disengagement, describes with the point a circular course round the adversary's blade, until it meets it again in the line of the original engagement, throwing off the attack in an opposite line from that in which it is directed.

This circular movement—done by the action of the fingers more than by that of the wrist—commences under the adversary's blade in the high lines, and over his blade in the low; thus, from the engagement of quarte (the foils joined on the inside), on the adversary's disengagement the circle is described by lowering the point, passing it under his blade, towards the right, returning upwards, and resuming the position of quarte.

From the engagement in the other lines, the disengagements are parried upon the same principle, as will be clear if you refer to the diagram, where the arrowheads denote the course taken by the foil.

The counter or round parry may also be used to meet a direct thrust, with-

LOW LINES

FIG. 13.—DIAGRAM ILLUSTRATING THE LINES OF DEFENCE.

out disengagement; in quarte, by dropping the point under the adversary's blade and circling upwards, throwing off the attack in the opposite line, that of tierce; in tierce, by the reverse action, throwing it off in quarte.

The parries are termed *semi-counters* when, by a half-circular action, the attack is thrown off from a high line into the opposite low (e.g., from quarte to seconde), or brought upwards from a low line into the opposite high (as from septime to tierce).

As a general parry a circular or deep elliptic movement of the point directly in front of the body, from right to left, or left to right (the hilt maintained at the centre), may be adopted. (See "Oval Parry," in Fig. 13.)

Two or more parries are often combined in continuous action, so that if the adversary's blade is missed in one line it may be met in another. A simple parry is performed after a counter, or a round parry after a simple. But systematic combinations are only to be learned by constant practice; the great thing is to take pains in studying the correct formation of the regular parries.

Fig. 14.—THRUST IN QUARTE.

And here it may be observed that all these parries which have been indicated and described are not of equal importance. Tierce, with its counter (or the outer circle), and quarte, with its counter (or the inner circle), should be principally employed (Figs. 11 and 12).

In parrying during the action of recovering from the longe, the outer circle is preferable to the inner. All other parries are but variations of quarte and tierce in lowering or raising the point.

Practice in Parries.—Engage in quarte, press the instructor's blade lightly—you have the advantage, being protected while he is exposed. He therefore disengages, by directing his point under your wrist, with the intention of passing to the opposite side of your blade. Before his point is raised, lower your own by the action of the wrist and fingers, with the nails up, and in straightening the arm. You have parried, *half-circle*, in the inside line low. He disengages by passing his point over the forte of your blade. Turn your nails down, pass the hilt a little to the right, on the same level, and catch his blade with the forte of your own; you have parried *seconde* in the outside line low.

He disengages by raising his point above your hilt. Raise your hand and point, bending the elbow, and catching his blade with the forte of your own.

You have parried *tierce* in the outside line high. He disengages by directing his point past your blade. Turn your nails to the left, catching his blade with the forte of your own. You have parried *quarte* on inside line high, the original engagement.

The Attack.—The thrusts are named, like the parries, quarte, tierce, &c. So also are the engagements: when the foils are joined in the inside high, you are engaged in quarte; on the outside high, in tierce; and these two engagements are almost universally adopted. though there is no rule to that effect, the position of quarte, indeed, is that into which you naturally fall on coming on guard.

Suppose you are engaged in quarte, then while your adversary's blade is in a true line it is evident that a very slight movement of his hand to the left would

turn aside a direct thrust; or if he were to extend his arm at the moment of your lunge, you would throw yourself upon his point. You therefore seek, by pressing with the forte of your sword upon the faible of his, to force it out of the line.

If he allow you to do this, his breast lies entirely exposed to your attack, and a direct thrust will hit it without risk to yourself, his point not being directed towards your body; so that if he should thrust simultaneously it must go past you, and he will be the only one struck; and as Motière's fencing-master explains to his pupil, the *Bourgeois Gentilhomme*, the art of fencing lies in two simple things—to hit, and not to be hit (Fig. 14).

But suppose your adversary obtains the advantage in the engagement, and that his sword commands yours, the direct thrust becomes impossible, and you must *disengage* to get an opening.

The more completely his inside line is guarded (you are engaged in quarte, remember) the more exposed must he be on the outside line.

Lower your point, then, under his hilt, straightening your arm as you shift to the outside line, and lunge like lightning.

Rapidity is everything in the disengagement; so you must be careful not to draw your point back, instead of merely lowering it, and not to make a wide

semicircle round your opponent's blade. Your foil should slip, as it were, from quarte to tierce, close to his, acted on by the fingers only (Fig. 15).

Rapid as you are, your adversary is as quick; his eye is fixed on your wrist; his foil, touching yours, aids him to divine your intentions, and the moment you disengage he is ready with his parry in tierce or seconde before you lunge.

In this case you seek your opening by a second disengagement, and hit him in quarte after all.

Fig. 15. — THRUST IN TIERCE.

This double disengagement is called the "one, two," and is very hard to defeat with two simple consecutive parries; for the formation of the first leaves the breast so much exposed, that it is barely possible to form the second in time.

It is therefore met with the counter or round parry. How are you to receive this? By a counter-disengagement—that is, by letting your point follow his blade round the circle it describes until the position of the first disengagement is resumed, and then lunging.

The opponent seeks to defeat this attack by a combination of simple and counter parries, which is to be evaded by a similar combination of disengagements and counter-disengagements, unless arrested in their action by a beat, wrench, or pressure upon his blade.

Binding. In a counter-disengagement your foil follows and avoids that of the adversary; when, on the contrary, your blade clings to his as it turns with it, in conjunction with the delivery of your thrust, it is termed binding his blade.

The favourite attack formed on this principle is termed the *flanconade*, and directions for the conduct of it will best explain the principle.

Draw your wrist sufficiently in towards your body to enable you to oppose the forte of your blade to your antagonist's faible; then suddenly from that position bind your sword over his, and without quitting it bring your point in a line with his body under his arm, and immediately longe, strictly in opposition; which will here be in octave.

This direction is Roland's, and he adds that the attack is most useful against an adversary who, being taller than yourself, depends upon his own superior length of reach, and stands with his arm extended, intending to oppose a straight thrust to any longe you may make; which, though bad fencing, might succeed if you quitted his blade to make an attack.

The Opposition mentioned above is that of the one blade against the other. If the swords are not in opposition, you cannot presage an attack, and are therefore unable to ensure against mutual hits.

The Change of Engagement differs from a disengagement, inasmuch as it is a mere shifting of your foil from one side of your adversary's to the other without straightening the arm; it is an attack upon his blade only.

In the high lines it is performed by a circular movement which carries the point of your sword under that of your adversary. In the low lines, by passing over the forte of his blade into the opposite line.

When an adversary changes his engagement, follow him, so as to prevent his gaining the command of your blade; if he beat, do not change engagement, but disengage.

During a succession of changes of engagement, remain always on the *qui vive* to parry; for your adversary will convert his change into a disengagement in a moment if he catches you napping.

Feints are used to bring an adversary, who seeks an advantage by refusing his blade, to an engagement, or to draw him from his line of defence. They may be either offers of direct thrusts or disengagements without longeing.

A *Beat* is a sharp blow on the opponent's blade with the purpose of confusing him, or throwing his weapon off the line preparatory to a feint or attack. But a frequent extension of the right arm without longeing is to be avoided.

Cut over Point.—The attacks which have been hitherto mentioned are directed either below the adversary's hilt or to one side or the other of his blade; there is another in which you seek to reach the adversary's breast by a whip over his weapon; raising your point, clearing his, extending your arm as your point descends again, and longeing when it is extended; these motions, of course, being simultaneous, when you have learned to perform them with accuracy.

The action may be exemplified by taking a cricket stump and fixing it in the ground by a downward throw. The action is that of striking or cutting, but the result is to fix the point in the spot aimed at.

Never attempt the cut over in loose play until you are perfect at it, or you will slash your unfortunate opponent over the arms and shoulders, instead of striking your point upon his breast; and a cut from a foil is no joke, even through sleeves of stout leather.

You would naturally imagine that the most dangerous moment for a fencer must be that following an unsuccessful attack, and this is indeed the case. The return thrust is called

The Ripost, and more hits are made by it than by any other form of attack. Nothing pays better than the constant practice of the direct ripost with the instructor, or an opponent acting in that capacity.

Commence carefully, paying great attention to the proper and strong formation of the parry, that the attacking blade may be thrown out of line, and then, from the position of the parry, without longeing (the adversary's body being

brought within distance by his *longe*), without any movement but that of the sword-arm, thrust in return.

Then, as you acquire precision, make the ripost more and more rapidly until that and the preceding parry become almost one movement to the eye of a bystander.

Rapidity is the great thing, the formidable element in the ripost; give the adversary too large a fraction of a second, and he will have recovered; the opportunity has gone.



Fig. 16.—HAND IN SUPINATION.

Some men who never attain to any great proficiency in the higher branches of fencing—who never learn, that is, to fence with their heads, carrying out a combination of attacks studied beforehand, are, for all that, extremely dangerous opponents from the lightning rapidity they have acquired in the ripost, with and without *longeing*.

The ripost is generally delivered with the hand in supination (Fig. 16), but sometimes, when executed from a parry in which the nails are turned down, as from *prime* or *seconde*, there is advantage in keeping the hand in pronation (Fig. 17) during the return thrusts.

But the ripost with the mere extension of the arm is not always feasible; the adversary, feeling his thrust parried very early, may recover in time, and yet leave an opening; then the ripost must be accompanied by the *longe*.



Fig. 17.—HAND IN PRONATION.

These riposts, so deadly from their rapidity, are called *direct*, but if you are quick enough to seize the opening afforded by the adversary's attack, and find the line of direct return closed, you must make your ripost by *disengaging*, cutting over the point, or passing under the hilt, either with or without the *longe*.

The Remise.—When the original attack is yours, and your adversary delays the ripost after having parried, especially if the parry has been widely formed, so as to afford a good opening, you may repeat your attack while on the *longe*, without springing up to the guard again in the ordinary way. This is called the *remise*; and being made in consequence of an error in your opponent's play, and therefore with a more

Fig. 18. TIME OVER THE ARM.

than average prospect of success, is to be carefully distinguished from

The Reprise, which is also a redoubling of the attack while on the *longe*, but made without reference to the opponent's play.

To attack originally with the foregone intention of making a second thrust (should the first be unsuccessful) while on the *longe*, whether the attack is met skilfully or the reverse, that is the *reprise*, and it had better be avoided by those who wish to acquire good form and steadiness, as it is apt to induce a rough, scrambling, haphazard style of fencing.

There is another sort of *reprise*, however, which is legitimate enough, and

that is a sudden repetition of the attack made, not upon the lunge, but after recovery to the position of defence.

Time Thrusts are so called because their success depends entirely upon their being timed exactly as your adversary is planning or executing an attack on you. You trust in forestalling it, instead of turning it with a parry.

When they are made correctly they are highly scientific movements, requiring great judgment in planning them, and great accuracy and precision in their execution. The adversary must either be led by a carefully thought-out stratagem to make the attack you wish, or else you must be able to discover that which he is intending to make, and have sufficient quickness and decision to time him as he commences his feint, or to wait for his lunge, as the occasion may require.

Time thrusts are made either in opposition (with the swords crossing) or out of opposition (with the blades not meeting). Those in opposition are the least exposed to the danger of an exchange of hits, and of these there are two, the time over the arm, and the time in octave.

Fig. 19.—TIME IN OCTAVE.

Time over the arm (Fig. 18) is applicable to all thrusts when the lunge is made on the outside. Time in octave (Fig. 19) is employed when the lunge is directed to the inside of the body or under the arm.

Time thrusts out of opposition are only to be employed where the adversary exposes himself, either by exceeding wildness in attack, drawing back his arm to thrust, or longeing without straightening it. In short, they are not to be thought of if your opponent fences in any form whatever. Even the legitimate time thrust, made with the swords in opposition, is a thing to be avoided unless you are quite sure of what you are about; for if you make the slightest mistake a mutual hit is hardly to be avoided.

Fencers who practice without a master should make it a rule to go through a longeing lesson before they commence; first one putting on the plastron and acting as instructor, and then the other. A very simple exercise will suffice if the men have but once learned, say this:—

On guard, engage in quarte; disengage, lunge, recover in tierce.

Engage in tierce; disengage, lunge, recover in quarte.

Engage in quarte; mark one, two, lunge, recover.

Same from engagement in tierce.

Engage in quarte; disengage, the instructor parrying with the counter, follow him round, lunge.

Same from tierce, lunge.

Bound quarte; round tierce, lunge.

Instructor disengages; parry simple, lunge.

Instructor disengages; parry counter, lunge.

Engage in quarte; beat and lunge.

The same; beat, one, two, and lunge.

Same in tierce.

In these exercises the pupil must touch the plastron when he lunges. The instructor, when he disengages, need not lunge; it will be sufficient for him to point his foil towards the other's breast, to show the attack. To fill his part usefully he must pay great attention to the other's form, and check him if he fails to straighten his arm properly before lunging, if he bends forward, over-lunges, leans on the plastron, or is slow in recovery, or neglects to lower his left arm. The pupil, in lunging at the plastron, is to relax the grasp of his fingers and raise his hand as high as the face as his point touches.

If you cannot get any one to take the part of instructor, lunge at the wall, paying strict attention to the position of your arm, body, and legs, for a little time before commencing loose play. By this means you will in some measure check the deterioration in style which is apt to attend too constant fencing without intervening lessons from a qualified master.

Fig. 20.—RESTING ON THE
LUNGE—POINT TOWARDS BODY.

ness and a correct position may be maintained, and that is by two fencers keeping up the old-fashioned custom of

For a couple of ordinary amateurs to attempt to practise the more intricate exercises together would, however, be of such doubtful advantage that we do not think it advisable to give them here. But there is another way in which steady-

THRUSTING IN QUARTE AND TIERCE

before they commence loose play.

The exercise, which is a very showy one, is thus performed:—The fencers, fully accoutred, with the exception of their masks, which are laid on the ground at their sides, face one another in the upright position, with their left hands hanging easily, the palm upon the thigh, the points of their foils presented towards each other. Then, bringing their weapons to their left sides, and raising both hands above their heads, as shown in our remarks on position (see pp. 144, 145), they come on guard, crossing swords in the engagement of quarte, beat twice with the right feet, and expose their breasts, with their hands in tierce. Then one proves distance by lunging in quarte, reaching, but not actually hitting, the other. Next, both rise to the upright position by bringing the right heel to the left instep, and salute the spectators by turning the sword-hand to quarte, to tierce, with corresponding movements of the head and eye, and then saluting one another in a similar way, they bring the foil to the left side, and come on guard as before, repeating the movements of raising both hands above the head, &c.

Fig. 21.—RESTING ON THE
LUNGE—POINT TOWARDS
SHOULDER.

The one who has proved distance now disengages into the outside line high, nails up, maintains the opposition of the blade, and directly the disengagement is fully developed and the other's parry felt, slackens his hold upon the grip, and, by reversing his fingers, turns the point towards himself, the pommel towards his adversary. In this position he rests a little on the lunge (Fig. 20).

Meantime, the other parries tierce on the disengagement, and presents his

point as in return of seconde, but without touching. The fencer on the attack recovers in tierce, disengages in quarte, again reversing the point, in this instance towards his right shoulder, the pommel towards his adversary, the eye glancing over the arm (Fig. 21).

The defender parries quarte, and presents his point as in the return of septime (a half-circle), but without touching.

After repeating these longes a few times, the fencer on the attack pauses in quarte, beats twice with his foot, and offering his breast, by turning his hand and blade aside in tierce, affords the other the opportunity of longeing, in his turn, to prove his distance. Both rise to the upright position, salute to right, to left, to each other, as before, and fall on guard. He who first attacked now parries, and *vice versa*.

Upon the termination of the thrusting, the double beat with the foot, and the *one, two*, both regain the upright position, and then move the left foot one step backwards, falling on guard; beat twice with the right foot; bring the left foot up to the right, again assuming the upright position, salute in quarte and tierce, fall on guard, the right foot in advance of the left, beat twice again, bring the left foot up to the right, reassuming the upright position, and at the same time salute each other by bringing the hilt up to the mouth, and lowering the sword slowly.

Captain Chapman likewise recommends practising the counters of quarte and tierce: the fencers dispensing with the salute, wearing their masks, and longeing with the intention of touching, but always waiting until the position of defence is perfectly recovered before passing the disengagement.

After a few thrusts, on both sides, from the engagement of quarte, and upon which the counter of quarte should always be taken, the players should change their engagement to that of tierce, when, upon the disengagement and longe, the counter of tierce becomes the necessary parry.

Fig. 23.—HAND AND HILT DURING THE "SALUTE."

The two diagrams (Figs. 22 and 23) representing the positions of the hand and hilt, while resting on the longe during the performance of the salute, are taken from Captain Chapman's admirable work, "Foil Practice."

Some men are put off their play when they find themselves engaged with a left-handed fencer, but there is no real reason why they should be. All you have to do is to watch the hilt, feel the blade, and attack where you see an opening. Keep cool, and you will find that the parries required are precisely the same as on ordinary occasions.

Have nothing to do with the charlatany of the art, such as seeking to disarm your opponent, the volt or springing aside, &c. &c. Nothing pays like steady fencing, and the acquisition of the utmost rapidity.

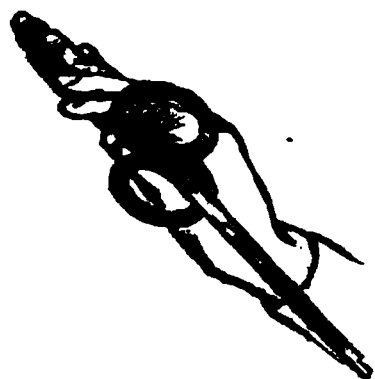
There are, indeed, a thousand combinations and intricacies, which are to be learned by an apt pupil who has the rare good fortune to meet with a talented instructor; but the more haste the worse speed is as true of fencing as of anything else.

When mutual hits occur, the hit is reckoned in favour of the fencer making the attack, provided the attack does not occupy an unreasonable time in its delivery. When mutual hits occur between the remise and the ripost, the hit is reckoned in favour of the fencer making the ripost.

The faults which fencers have to guard principally against in loose play are—



Fig. 22.—HAND AND HILT DURING THE "SALUTE."



closing upon each other, overlungeing, pressing on the longe, repeating the attack without regarding the opponent's ripost, and drawing back the arm to deliver the thrust.

We will conclude with a few general rules, which will pay right well for careful attention.

Engage out of the immediate reach of your adversary, and always cross his foil, if possible, in quarte or tierce; but your guard must be relative in height to his.

If your adversary will not cross blades, threaten him with the point, but do not longe under such circumstances, that is, out of opposition, unless you have a very decided advantage over him in reach.

If he raise his point, beat sharply, and longe. If you are the taller, attack; if the shorter, trust chiefly to the ripost.

Do not be disconcerted when you find your foil jarred and crossed in contraction, from your opponent having parried in an irregular fashion. With a little practice you will see how to avoid his blade, and profit by the irregularity.

Whip along the blade in tierce, or wrench over it from the engagement of quarte, when the adversary engages with a straightened arm, or attempts to arrest the attack by extending it.

Disengage into the opposite line when the adversary attempts to beat.

Yield the wrist and blade to his action, without quitting his weapon, when he attacks by encircling the blade, for by yielding the wrist the foil is brought round to the original engagement.

Beat or wrench before riposting, when the adversary rests upon his longe.

Regain the position of defence immediately after the longe, whether successful or not.

Feign the semblance of disengagement, in order to observe your adversary's usual manner of parrying, so as to plan an attack upon him.

If he tries that upon you, adopt some particular parry in order to draw an attack founded upon it, which you will then be prepared to meet and turn to advantage.

All disengagements made under the wrist are more dangerous than those made close along the blade. It is easier to cut over the point when the adversary's guard is low and his point high, and your forte therefore near his faible. And it is easier to hit with a disengagement when your point is near his forte.

Watch good fencers whenever you have a chance.

BROAD-SWORD OR SINGLE-STICK.

WE have treated hitherto of the thrusting sword, and the rules for its use only; we now come to the consideration of weapons which are used simply for striking, or for both cutting and thrusting, as well as of those where the point alone is employed, but which are wielded with both hands.

The single-stick, which represents the broadsword, as the foil does the small sword or rapier, is an ash plant, pickled and baked, with a little peg driven through at the handle end to keep it from slipping through the guard. This used formerly to be made of wicker work, but is now generally of buffalo hide, which lasts almost for ever, while the baskets are soon knocked to bits.

Defensive clothing is not of so much importance as in fencing; the only disadvantage of dispensing with it altogether will be a few stinging cuts raising weals and possibly causing a slight abrasion of the skin, with the exception, indeed, of the face, over which a mask must be worn for the protection of the eyes, which might possibly receive injury from an unlucky blow.

THE POSITION.

Assume the military attitude of *attention*, i.e., shoulder and body square to the front; heels in line and closed; toes turned out at an angle of 45° ; arms hanging easily from the shoulder; hips rather drawn back, and the breast advanced, but without constraint; the body straight and inclining forward, so that the weight of it may bear principally on the fore part of the feet; the head erect, but not thrown back, the chin slightly drawn in.

FIRST POSITION IN THREE MOTIONS.

One.—Move the hands to the rear, the left grasping the right arm just above the elbow, and the right supporting the left arm under the elbow.

Two.—Half face to the left, turning on the heels, so that the back of the left heel touches the inside of the right heel.

Three.—Bring the right heel before the left, the feet at right angles, the right foot pointing to the front, and the weight of the body resting on the left leg.

SECOND POSITION IN TWO MOTIONS.

One.—Bend the knees gradually, keeping them as much apart as possible, without raising the heels, or changing the erect position of the body.

Two.—Step out with right foot about eighteen inches in line with the left heel, the weight of the body remaining on the left leg, the right knee easy and flexible.

THIRD POSITION IN TWO MOTIONS.

One.—Incline the right side to the front.

Two.—Step out smartly to the front, about thirty-six inches, the knee perpendicular to the instep; the left knee and foot kept straight and firm, the heels in a line, the body upright, and the shoulder square to the left. From the third position the pupil must practise springing up both to the first and second positions.

FROM THE SECOND POSITION.

Single Attack.—Beat the ground smartly with the right foot.

Double Attack.—The same, twice, first with the heel, then with the flat of the foot.

Advance.—Move forward the right foot six inches, then bring up the left.

Retire.—Move the left foot lightly to the rear six inches, the weight and balance of the body being and continuing to rest upon it; then move the right foot back the same distance, and place it smartly upon the ground.

You may easily practise the cuts, thrusts, and guards by yourself, if you have the regulation target (Fig. 24) drawn on the wall before you. It should be of good size, and so placed that the centre is about the height of your breast. It may be roughly chalked on the wall of a garden or an outhouse, or drawn upon calico and hung up. Though the stick is employed for loose play, it is well to go

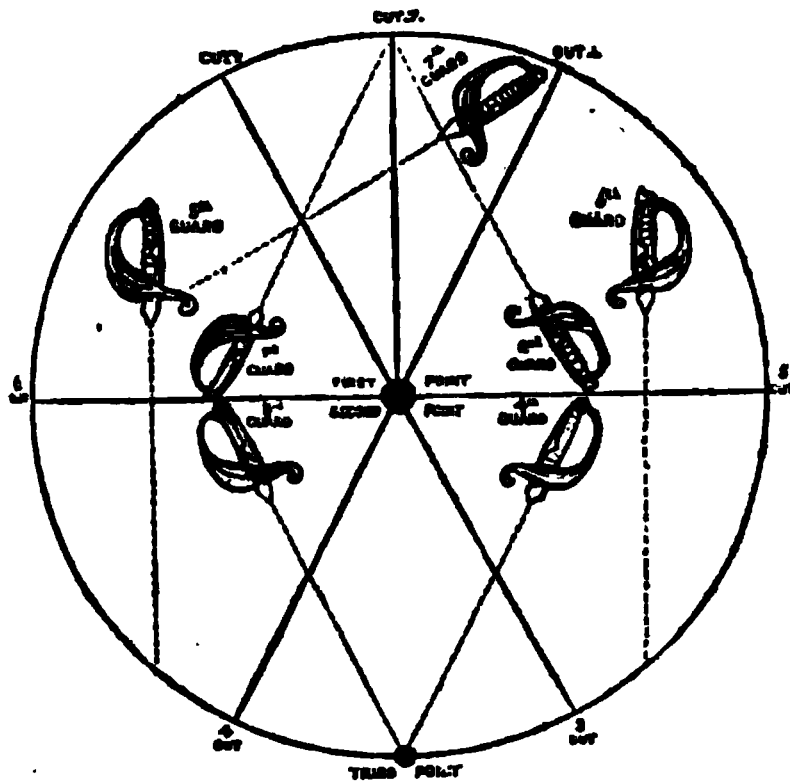


Fig. 24.—TARGET FOR SINGLE-STICK PRACTICE.

through the practices with a real sword, that you may learn to strike with the edge, not the flat of the blade, and may also perceive practically the necessity of guarding with the forte, and striking with the faible of your weapon.

Of course the target merely shows you how to form the cuts, not exactly where to cut, as that must depend on the opening afforded by the adversary.

Cuts 1, 3, and 5 can be directed at any part from head to foot on the inside; cuts 2, 4, and 6 on the outside.

Take up a position in front of the target.

Draw Swords.—Seize the scabbard with the left hand just below the hilt, which should be raised as high as the hip; grasp the hilt, turning it to the rear with the right hand; raise the hand the height of the elbow, partially drawing the blade. Draw the sword from the scabbard with an extended arm, the edge to the rear, and lower the hand until the hilt is just below the chin, the blade perpendicular, the edge to the left, the thumb extended on the side of the handle, elbow close to the body. This is the position of "Recover Swords."

Fig. 25.—SLOPE
SWORD.

By a third motion, lower the wrist below the right hip, the arm extended as much as it can be with ease. The upper part of the sword will then be in the hollow of the right shoulder, with the edge to the front. This is the position of "Carry Swords." The left hand quits the scabbard directly the sword is drawn.

Slope Swords.—Move the hand to the front in line with the elbow, which is close to the body, with the sword resting upon the shoulder (Fig. 25).

Prepare for Sword Exercise. Turn body and feet to the first position, with the left hand resting upon the hip, and thumb to the rear.

Right Prove Distance.—"Recover Swords," then extend the arm to the right, and lower the sword in a horizontal direction from the shoulder, with the edge to the rear.

Slope Swords.

Front Prove Distance.—"Recover," as before, then step out to the third position, and extend the arm, lowering the point of the sword to the centre of the target, with the edge to the right (Fig. 26).

Slope Swords.

Fig. 26.—FRONT PROVE
DISTANCE.

Assault.—Raise the arm to the front, with the wrist opposite No. 1, and the back of the sword resting on the shoulder, with the edge inclined to the right.

Cut One.—Cut in a diagonal line from No. 1 to No. 4; and as the point clears the circle, turn the knuckles upwards, and continue the sweep of the sword so as to bring the point to the rear of the left shoulder, upon which it rests, with the edge inclined to the left, and the wrist opposite No. 2.

Cut Two.—Cut from No. 2 to No. 3, and turn the wrist so that the sword-point comes below the right hip, edge downwards and elbow bent inwards, and wrist towards No. 2.

Cut Three.—Cut diagonally upwards from No. 3 to No. 2, and continue the motion of the wrist and arm in such a manner that the point of the sword shall be below the left hip, edge downwards, the elbow bent, and raised with the wrist towards No. 1.

Cut Four.—Cut upwards from No. 4 to No. 1, and turn the knuckles downwards, with the edge of the sword to the right, and the point to the rear over the right shoulder, the elbow bent, and the wrist towards No. 5.

Cut Five.—Cut from No. 5 to No. 6, and turn the knuckles up, with the edge of the sword to the left, and the point to the rear, over the left shoulder, the elbow bent, and the wrist towards No. 6.

Cut Six.—Cut from No. 6 to No. 5, and bring the hand in the direction of No. 7, the sword being brought directly over the head, point lowered to the rear, edge uppermost.

Cut Seven.—Cut down from No. 7 to the centre of the circle (no farther, mind), and remain with the arm extended, placing the thumb along the back of the handle, and the left shoulder well pressed back.

First Point.—Turn the edge of the sword up to the right, and draw the wrist back to just above the right eye. By a second motion, deliver the point in the direction of the centre of the target, with the wrist raised inclining to No. 1, pressing back the left shoulder so as to advance the right.

Second Point.—Turn the edge upwards to the left, draw the hand back to the centre of the breast, the thumb being on the right of the handle, and give point as before, the wrist raised and inclining towards No. 2; nails up.

Third Point.—Draw in the hand to the hip, turning the handle to the right during the motion, so that the edge of the sword is uppermost, and the guard touches the back of the hand. Then deliver the point towards the spot marked at the bottom of the target, and raise the wrist towards the centre. This represents the attack, and, according to the theory of the old trooper, should end the lesson.

First Guard.—Keeping your position in front of the target, place your sword exactly opposite the dotted line marked "First Guard," so that it corresponds with it. The edge must be turned to the left, as the cut to be guarded comes from that direction; for edge must always be opposed to edge. Let the elbow be close to the body, the wrist to the front. The left shoulder in this and the other guards on the inside should be kept back; in the outside guards the "Seventh" and "Parry" rather brought forward.

Nails up; point of sword inclining to the front.

Second Guard.—Turn the nails down, bringing the edge of the sword to the outside, and let the sword correspond with "Second Guard" on the target.

Third Guard.—Turn the wrist and edge to the left, a little below the shoulder, with the point lowered to the right, the sword corresponding with the "Third Guard."

Fourth Guard.—Turn wrist and edge to the right, with point to the left, raising the elbow as high as the shoulder; the sword corresponding with dotted line marked "Fourth Guard."

Fifth Guard.—Turn the edge to the left, raising the wrist as high as the shoulder, to the left front of the body, letting the sword correspond with the "Fifth Guard."

Sixth Guard.—Bring the sword across the body so as to be exactly opposite the "Sixth Guard," bending the wrist.

Seventh Guard.—Raise the wrist above the head, keeping the elbow well back, and let the sword correspond exactly with the dotted line marked "Seventh Guard."

Parry.—Lower the wrist till it is close to the right shoulder, the edge outwards, to the right, the hips well pressed back. Then turn the wrist so that the point of the sword sweeps downwards towards the left rear, forming a circle from left to right, and returning to its former position.

To secure the edge leading in the cuts, it is well to practise those which take

the same line in the reverse way several times together, *e.g.*, Cut 1, and then immediately Cut 4; then combine 2 and 3, 5 and 6.

The cuts, guards, thrusts, and parry having been thus learned in the first position, the three engaging guards are now to be acquired, and the cuts and guards combined. The cuts and points should be given from the wrist to the full extent of the arm, and in the third position; the guard and parry formed in the first position, in which also prepare for each point.

Slope Swords.

Hanging Guard.—Advance the wrist, and raise it to a level with the top of the head, extending the arm, and turning the elbow outwards, and the point of the sword down and inclined to the left, edge upwards, at the same time step out to the second position, bending the body, drawing in the chest and neck, and bringing the left shoulder a little forward, and looking at your adversary or the target under your hilt. This is the guard generally adopted in loose play (Fig. 27).

Fig. 27.—HANGING GUARD.

Inside Guard.—Raise the head and body, lowering the sword hand with the nails up; point of the sword to the front, the edge inwards; elbow in front of and a little above the hip; at the same time make the "Single Attack" with the foot (Fig. 28).

Outside Guard.—Turn the nails down, bringing the edge of the sword outwards, and repeat the "Single Attack" (Fig. 29).

Now go through the cuts and guards in combination.

Out one and third position.

First guard and first position.

And so through all of them; springing in each instance from third position to first.

When two pupils can do this steadily, they should be placed opposite each other, and cut and guard alternately, *viz.*, both being at the hanging guard, at the word *One*. One of them forms the first guard in the first position, and the other makes the first cut upon it in the third position; springing up to the first position, and forming the second guard to receive the second cut from the other at the word *Two*. And so on.

Fig. 28.—INSIDE GUARD.

When the sword is exchanged for a stick, and a mistake in the formation of a guard would, therefore, be of slight consequence, alternate cuts and guards which do not follow in the regular order should be combined. There are several of these practices ordinarily adopted before loose play is commenced. This is one—A and B are opposed.

Guard	Both come on Guard:		A		B	
	A	B	Leg	Cut 4	4th Guard	B
Head	Cut 7	7th Guard	Leg	4th Guard	Cut 4	Cut 4
Head	7th Guard	Cut 7	Head	Cut 7	7th Guard	7th Guard
			Head	7th Guard	Cut 7	Cut 7

Or in the above practice, do not guard cut 4, but form guard 7 against a feint from leg to head; trusting to the springing up to the first position alone to get

the leg out of the way. This is the usual method, indeed; but for all that it is better to form the proper guard.

This is another practice :—

Guard	A	B		A	B
Head	Cut 7	Guard 7	Head	Cut 7	Guard 7
Head	Guard 7	Cut 7	Head	Guard 7	Cut 7
Arm	Cut 2	Guard 2	Right Side	Cut 6	Guard 6
Head	Guard 7	Cut 7	Head	Guard 7	Cut 7
Head	Cut 7	Guard 7	Head	Cut 7	Guard 7
Arm	Guard 2	Cut 2	Right Side	Guard 6	Cut 6
			Guard	Slope Swords.	

In independent practice with the sticks, it is not necessary to keep so closely to the theory as in fencing; indeed, some of the broadsword directions are more honoured in the breach than in the observance; when you come to their practical application, though, considered as gymnastic exercises for giving suppleness and strength to the wrist and arm they are excellent. Otherwise it is difficult to imagine that the legitimate parry could ever be performed with success, unless you got your adversary to be so kind as not to thrust before you were ready with it; and the three thrusts would be fine things to make at a man who was running away, as you chased him. But if he were facing you, with a sword in his hand, and knew anything of fencing, he would simply transfix you the moment you drew back your arm.

To throw the weight of the body entirely on the left leg again is a less desirable position than the equal balance upon both legs. The great idea of it is to be able to draw back the leg when cut at, and return at the head. But the stick represents a sharp weapon, and who in his senses would lay the whole of his head and body exposed to a razor edge while he went mowing at his adversary's legs? With the stick, indeed, it might be tempting sometimes to risk the exchange of a cut on the other man's leg, which stings him, for a stroke on your own helmet, which cannot be felt. But it is not difficult to stop that game. Then, whenever your adversary cuts, or feints strongly at your legs, cut at his arm—it is the safest possible attack, being at the same time a parry.

FIG. 29.—OUTSIDE GUARD.

It is by cuts 3 and 4 at the arm that the broadsword might have a chance against the rapier. Against a mounted opponent the swordsman must endeavour to gain his left side; if he can do that he must obviously have the advantage.

The best thrust from the hanging guard is simply to straighten the arm in a downward direction, which is, indeed, the thrust in seconde.

It is no uncommon thing for men to play at stick and bar thrusting, but it is a thoroughly bad plan, for those who pursue it are certain to get too close, hit wildly, and counter. It is true they may plead ancient custom on their side; in the old English back-sword and cudgel play there was no thrusting, nor was upper-cutting generally thought fair, though the rules differed in different counties. First blood from the head decided the bout.

The German student's favourite weapon, the schläger, is pointless, being as blunt and square at the end as a razor; but as they only cut at the face, there is little variation in their play, and the victory mostly falls to the arm which can last longest without drooping from weariness.

But with every respect both for antiquity and Teutonic customs, we still think it the greatest mistake to mutilate stick play by extracting the point. It

is stupid to see two fellows simply thrashing each other without any exercise of skill, and it is sure to come to that when they lose their tempers, if there is no thrust allowed to keep them at a proper distance.

The reason why cutting only is practised, is a fear lest the point should be too punishing, but this is easily obviated by loosening the hold of the stick at the moment of thrusting, when it will slide up through the leather hilt, and the hit will be innocuous.

The rules laid down for independent practice with sticks should be adhered to as strictly as possible; though it is difficult always to combine a light hand with rapidity.

RULES.

1. The cut and thrust must not be given too strongly, so as to cause irritation and anger.

2. Each cut or thrust to be acknowledged by the person touched, passing the stick into the left hand, the opponent recovering to an engaging guard.

3. The combat to be renewed out of distance, the parties coming within it cautiously.

4. No two cuts or thrusts to be made upon the same longe. In case of a mutual hit, the cut given in the third position to be reckoned only.

5. All cuts being made from a defensive position, such must be returned to as soon as the cut or thrust is delivered.

6. No practice to be allowed without masks; and as the stick is the substitute for the sword, the cut can only be considered effective when given with that part which corresponds with the edge, nor should any movement of attack or defence be attempted with the stick which would not be risked in a combat with swords.

An old proverb avers that rage strikes, but revenge stabs. It has also been asserted by several writers on the subject that men in a state of barbarism hit only, and that the practice of thrusting at their enemies is a distinguishing mark of civilisation. Now, whether Englishmen are more passionate than revengeful; or whether the savage instinct is still strong in them, it is certain that they evince Richard Cœur de Lion's partiality for a good downright blow; and in establishing a fencing school or gymnasium it is astonishing how much more readily men will take to boxing or stick-play—which represents the broadsword—than to the foil; though when they have once made a certain progress in the art of fencing proper, they perceive that to prefer the other exercises is much like taking to rounders rather than cricket, or choosing bagatelle before billiards. One great reason for this prevalent taste is doubtless this: that many men cannot take pleasure in any contest unless there is a risk of pain or loss in it. They must either have their purse or their cuticle at stake, or they are unable to feel the requisite interest. Now, the thrust of a foil does not hurt, a blow from a stick does, even through the leather.

There is this to be said, however, for the broadsword, that it is a far better exercise for those who have never learned fencing, who have no means of getting lessons from a good master, and no patience to practise book rules together for a sufficient time before taking to loose play. For men to fence together with foils, knowing nothing of the art, cannot be too strongly deprecated. The difficulty of unlearning all the bad habits they must necessarily acquire will be almost insuperable, and it will prove poor sport besides. But with the broadsword it is different; if the combatants will observe certain simple rules, which we have given, they may set to as often and for as long as they please without learning any faults which a few good lessons with the foil will not at any time eradicate.

BOXING.

THOUGH to many people the sentiment may seem absurd, I assert, with all earnestness, that the Englishman who cannot swim and box is imperfectly educated, even if he knows as much about mathematics as a senior wrangler, or can speak as many languages as a Russian. The swimmer can save himself and others very often without risk, simply from feeling at home in the water; the boxer can constantly protect the weak without actual violence, by just keeping a big bully at bay while the victim escapes and a policeman comes up, where the interference of a stronger man, who had never learned to spar, would only result in injury to himself without benefiting the object of his compassion.

It is all very well to laugh at the police for their absence in cases of riot, but they cannot be everywhere at once, and, unfortunately, while drunkenness is so common a vice in this country, acts of violence will occur in public places, and I do not know any spectacle more degrading than that of a fellow ill-using a woman or child, and men looking on without daring to interpose.

However, without insisting further on its utility, boxing is a capital exercise, with this advantage over fencing or single-stick, that there is no padding of the body or covering up the head with mask or helmet required. All you want are two pairs of boxing-gloves, and the tables and chairs put away to the sides of the room.

The gloves should be well padded, but not so stiff that you cannot clench the fist. Many spar with open hands, and flick over the guard rather than hit straight, but this is all wrong; the fist should be doubled, just as though it had no glove upon it.

It is a singular fact that the beginner is almost sure to put himself in an attitude which combines every possible fault. He plants himself firmly, braces up every muscle, and holds his hands high. Now it is impossible to be too easy and unconstrained, or to let the limbs play too freely. It is only at the moment of striking or parrying that the fist should be clenched tight and the muscles contracted. The left foot should be in advance, with the sole flat on the ground; the right foot about half an ordinary pace in rear, with the heel slightly raised, and the toes in line with the left heel; care being taken not to bring the left foot too far to the right, which would destroy the balance. The knees must be very slightly bent, just as in dancing. And mind carefully that when you advance, the left leg must always step out first; when you retire, the right leg must step back first. When you move to the left, the right foot takes the pace, the left foot following it. When you move to the right, the left foot is first shifted, then the right.

All this is very important, for if the legs and feet get confused, their owner must lose his balance, and become powerless either for attack or defence, and a slight blow will suffice to knock him down. You require to step forwards, backwards, sideways as lightly and quickly as possible, always keeping the right foot in rear of the left. Thus, when you deliver a blow the whole weight of your body is thrown into it; when you receive one, you give to it, as it were, and much of the force is lost. Or, if you step back very smartly, it falls short altogether, while, your left foot being still in advance, you are ready to step up again at the instant and deliver your return before your opponent can recover himself.

The left arm must be in advance, playing backwards and forwards easily, the fist about on a level with the centre of the chest. The right arm held across the body, but not stiffly (Fig. 1).

Keep the chin down *and the mouth shut*. If you want to know the reason for this last recommendation being printed in italics, you may have your mouth open, just for once, and get somebody to give you a slight tap on the jaw. But you had better take the hint without trying the experiment.

The beginner should, if possible, commence sparring with an antagonist who knows something of the art; but if this is impracticable, as in the case of a couple of lads at a country house who want to amuse themselves with boxing, let both follow the rules carefully, and stop directly they find themselves hitting wildly, or in any way approaching to fighting at close quarters—in-fighting, as it is called. So long as they keep to out-fighting, which is hitting and guarding at arm's length, they will be able to correct faults and improve themselves.

Once sure that they have got the correct attitude (Fig. 2), and having practised advancing, retiring, and stepping sideways, they should commence with leading off alternately. Let A begin, we will say, and B confine himself to the defence. A should weave round B with a series of side paces, his left arm playing easily backwards and forwards, though not more than a few inches, his right foot always retaining its position

Fig. 1.—POSITION.

with the heel off the ground, his eye never taken off that of his adversary, and measuring his distance. When he thinks he has got this accurately, he leads off with his left at the centre of B's face, not drawing back the arm for the blow, but simply straightening it as quickly and smartly as he can, at the same time stepping in with the left foot, the right coming off the ground; for the attack should be of the nature of a spring.

This lead off with the left at the head (Fig. 3) is the very groundwork of boxing, and cannot be practised too carefully. It must be a dart forward, with the whole weight of the body behind the blow, and the movement never can be rapid enough. The object is to strike before B can put his guard up, and the drawing back the hand, or the advance of either hand or foot, the minutest fraction of a second before the other would warn him of the attack and frustrate your intention. Take great care not to push or chop downwards; with big gloves on his own hands and on those of his opponent, the novice sees very little opening, and is apt to get into a slovenly style of hitting. Be sure, therefore, to clench your fist at the moment, and dart it out like a snake's tongue.

Fig. 2.—POSITION.

To guard his head B throws his right arm upwards and outwards, keeping

the elbow down, clenching the fist, and turning the wrist slightly outwards, the inner part of the forearm being less tender than that over the sharp bone.

When A can lead off cleverly and B throw the blow off neatly (there should be no fear of stopping it with his nose in this exercise, when he is aware of what is coming), B should lead off and A guard. And when both are pretty accurate, A should lead off, B parry and return; then B lead off, and A parry and return.

Then lead off at head; guard and return at head; guard and return at body.

When you are directed in sparring to hit at the body, the upper part of the chest is not meant, for that is so well defended by ribs that it would take the kick of a horse to stop a man. To hit below the waist, again, is a foul blow. But there is a region between the chest bone and the belt which is fair punching ground, and where a smart tap will knock all the wind out of the tappee's body, and sometimes quite double him up. This vital point is the "body," the "wind," or more colloquially the "mark," in boxing parlance.

In hitting with the left at the body (Fig. 4), slightly draw back the arm and turn the elbow outwards, ducking the head to the right as you advance the left foot, to avoid being stopped by a blow in the face, and spring quickly back before raising the head again.

The body is guarded by pressing the arm close to the body and receiving the blow upon it, or, better still, by divining your antagonist's intention, and stopping him before he can duck with a straight shoot in the face. But in merely practising the lead off mentioned—head, head, body—the former guard must be adhered to.

In loose sparring the body blow should generally be prefaced by a feint at the head, in order to draw the adversary's right arm up for the head guard, which will leave the "mark" open to your attack. The guard for this is to bring the left arm across the body to receive the blow, while the right is thrown up to guard the head (Fig. 4).

Feinting with the left is done by darting out the left arm, and slightly advancing the left foot; feinting with the right by advancing the left foot and drawing the right arm back.

Fig. 4.—HITTING WITH THE LEFT AT THE BODY.

To counter is to hit at the same time as your adversary, the object being to take a light blow and inflict a heavy one. Your eye must always be kept fixed on your opponent's, and thus you may often divine his intentions. When he is intent on aiming a blow at you he is thinking less of guarding himself, and if you can forestall him by the smallest fraction of a second, he is *hit off*, as it were, as he delivers his attack. As both bodies are converging at the time, a

Fig. 3.—LEADING OFF WITH THE LEFT AT THE HEAD.

counter is heavier than any other blow. The perfection of a counter is to avoid the other blow altogether, letting the hostile fist pass over your shoulder by a turn of the head, and at the same time to plant your own glove full in the middle of your opponent's face.

But I do not much recommend the practice of ducking until you have made some advance, can make sure of hitting quickly and strongly, and are active on the feet. Yet some of the prettiest attacks depend upon it—notably, the cross-counter with the right. When your adversary leads off at your head with the left, you avoid the blow with a turn of the head to the left, and simultaneously stepping in, swing your right into his jaw over his left shoulder. Of course it is easier said than done, and if you are not the quickest you get his left very severely on your nose; but it is very telling when successful.

An upper cut is delivered if your opponent holds his head down to receive your blows on his forehead. You guard your face with one arm, step in, and hit upwards with the other, the knuckle being downwards, and the elbow, of course, downwards also. Note this, for upper cuts delivered, as they often are, with the elbow turned out and the knuckles uppermost, have no powder in them whatever.

If you get to in-fighting, try to keep your hands inside your opponent's, and punch away with both of them at the face only, getting away to out-fighting again as quickly as possible.

Never strike with the palm of the glove, where there is no stuffing.

Never wrestle.

Stop when you find yourself swinging your arms wildly.

KEEP YOUR TEMPER.

WRESTLING.

It is very difficult to give directions for wrestling in intelligible language. If you had hold of me, I could say, "Now put your foot so, and turn your hip so—that's it; and now a sudden heave like *this*," and so forth. But on paper, or by word of mouth, it is different. The only consolation to me in attempting the task is that if you commence wrestling you will find out some of the "chips," as the tricks of the art are technically called, for yourself, and the meaning of them, and so of others, will become clear to you. For wrestling differs from some other exercises in this, that it does you no harm to commence unscientifically. In fencing or rowing, for example, a bad style once acquired is very difficult indeed to unlearn; whereas two beginners may wrestle together and learn something by practice and experience, and, when they get useful hints from an adept, will be the more able to turn them to account for their previous rough-and-ready attempts.

Well, at any rate, I can tell you how to take hold, and so start you fairly, premising that we follow the Cumberland and Westmoreland rules, ignoring Cornish and French wrestling altogether, as too rough for encouragement in any way.

On taking hold, then, the wrestlers stand chest to chest, each placing his chin on his opponent's right shoulder and grasping him round the body, each placing his left arm above the right arm of his antagonist (see figure).

When both have got hold, and are ready, they commence, and are allowed to use every means to throw each other, with the exception of kicking.

To *strike* an opponent's leg with your own leg, so as to knock it from under him and make him lose his balance, is not kicking, and is perfectly fair.

If either party break his hold—that is, leaves loose, though not on the ground—and the other still retains his hold, the one so leaving loose is the loser: it counts against him as a fall.

If the antagonists fall side by side, or in any such way that the umpires cannot decide which was first on the ground, it is called a “dog-fall,” and

must be wrestled over again. But if both fall, and one touches the ground first, or falls under the other, he is the loser.

If either combatant touches the ground with a knee, or any other part of his body, he is not allowed to recover himself, but is considered thrown, though he may still retain his hold.

These rules are few and simple: how can you get an advantage? Well, in the first place, in taking hold, your right arm is under your opponent's left; it is obvious, then, that the farther you can force your right shoulder beneath his armpit the greater purchase will you get; at the same time, you must keep your left arm well

THE HOLD

pressed inwards, to prevent his getting his right shoulder too far under your left armpit. If you get the best of this preliminary struggle for the grip, try to take advantage of it at once; but if your hold does not satisfy you, wait on the defensive, and try to make it a better one during the struggle.

The *Back-heel* consists in putting your foot behind your opponent's heel, and endeavouring to bend him over it. One great advantage of this chip is that it renders your own position so very firm. When the back-heel is put on you, the way to meet it is to suddenly slacken your hold (don't let go, mind, that cannot be done without losing), and try to turn your side for a buttock.

The *Buttock* is done by turning as far as possible, so as to get under your adversary, and so to shoot him over you. It is not easy to do, but is very effective when neatly managed. If you get him right, over your shoulder he is bound to shoot.

The *Hank* is a chip which any beginner might practise, without knowing what it was called. You simply turn sideways, twist your leg round that of your opponent, and endeavour by sheer weight and strength to pull him backwards and tumble on him. When the hank is tried on you lean forward, and strengthen your hold.

The *Cross-buttock* comes in when your adversary has succeeded in getting behind you; it is done by crossing both his legs with one of your own at exactly the right moment.

The *Outside Stroke*.—Lift your adversary and twist him round, striking his leg from under him with one of yours. Or, if you cannot lift him, make him walk round, and as he is lifting his receding foot strike it quickly. This is not kicking, mind. the leg is struck with the leg.

What is called the *Click* consists of pulling your opponent towards you, to make him resist you and drag back, and then unexpectedly darting forward and simultaneously clicking his left leg with your right (or his right leg with your left), and if he is pressing backwards at the moment, and is prevented by your click from stepping back to regain his balance, down he must come. If you click your opponent's right leg with your right leg (or his left with your left), it is called a "cross-click." If you are much stronger than your adversary you may throw him by grasping him firmly and swinging him from side to side till you have him over. This is the *Twist from the Chest*.

We now come to the *Hipe*, which is the high art of wrestling. Make your adversary go round to your left, at the same time getting your right shoulder as far as you can under his left arm; lift him up with all your strength; catch his left leg with your right leg, and drag it up. If all this is done simultaneously and cleverly, down he must come on his back. Or you may make him go round to the right and hipe him with the left leg, but your left arm being under his right you cannot lift him so high. However, if you fail you are then left in position for the buttock, as when he saves himself his left foot will touch the ground first, and you have the chance of crossing it with your left leg.

Another chip is to get your left leg round your adversary's right and raise it; then suddenly release it and cross the left leg, on which alone it has been standing, before he is firm upon the other. This is the *Hitch Over*.

To sum up, the first thing is to get your hold right, with hands clasped behind your opponent's back, not to be unclasped till the struggle is over. Then you endeavour to get him down by swinging him sideways, shooting him forwards, or pressing him backwards, these efforts being combined with varieties of tripping difficult to explain on paper. If I have done so with any clearness, it is only fair to acknowledge the assistance received from a few short paragraphs in Mr. Walter Armstrong's admirable little work recording the wrestling-matches of a London society, and entitled "*Wrestliana*." Its descriptions of the principal chips were so much more lucid than those in more elaborate treatises on the art that I took note of them, with practical advantages which I hope that you will share.

In the Cumberland and Westmoreland wrestling it is customary to take off the shoes, and contend in stockings, by which means kicking becomes impossible. I have said that this style of wrestling is the only one we need take much note of; but it is only fair to confess that there are other people who think differently, and Cornish men may boast that their style is the true old English one with some show of reason. For in it the competitors wear a short strong jacket, and the object in taking hold is to seize the jacket with one hand as far as possible behind the shoulder, and with the other to grasp the sleeve of the opposite arm about the wrist or elbow. And in the old accounts of the exercise we find that the hold was by the collar and waistband in ordinary wrestling, and when the competitors were stripped for the prize contests, in which no garments were worn above the waist, each had a girdle over one shoulder and under the other for his opponent to take hold of. And except in the Northern counties of England this was the accepted style of wrestling; and the great matches between London and Westminster, and those held at Bartholomew's Fair, were competed for in this manner. Indeed, the objection to Cornish wrestling lies, not in the hold, but in the practice of kicking.

GYMNASTICS.

It is only within comparatively recent years that gymnastics at schools have been pursued upon anything like scientific principles. Previously, it sufficed for boys to learn how to turn and tumble after their own devices upon a horizontal bar, or couple of parallel bars, erected usually in a gravel playground. Now, all that is altered, and in many places the exercise is looked upon as almost educational, as well as a pastime. This is as it should be; for as long as gymnastics are not carried to excess, they are of the utmost value for developing a boy's physique and muscle. They should, however, be used only as a means to an end, and not made a *speciality* of, to the exclusion of cricket, football, rowing, and other sports; for then, instead of becoming beneficial, gymnastics are really harmful, and tend to stunt the growth.

In the instructions which follow we have endeavoured to explain, as explicitly as possible, those exercises which a boy need not go to a regular gymnasium to learn; and although some difficult exercises are given, as a rule those feats which may be classed as extraordinary have been omitted; inasmuch as they should only be practised in a fitted gymnasium, where a regular instructor will teach more of them in a few hours of practical example than we could in years of bookwork.

APPARATUS.

As to apparatus, for all ordinary purposes the following appliances will be found sufficient:—

A horizontal bar, a pair of parallel bars, a pair of hanging rings suspended from a ceiling or bar, a horse or vaulting bar, horizontal, perpendicular, and inclined ladders, a trapeze, and a climbing pole and rope; together with dumb-bells and Indian clubs for hand exercises.

Of course, in an ordinary school gymnasium, all of these instruments may not be found; but boys who have acquired a taste for gymnastics have an inborn knack of meeting emergencies, and when not able to find apparatus, which perhaps more properly belong to a regular gymnasium, will not be long in discovering some substitute of a rough-and-ready character that will suit their purpose for the time being.

In the following article, consequently, exercises are given for the above appliances, as well as for so old-fashioned a friend as the giant-stride, still found in many a playground, and also for the inclined plank, a simple apparatus easily improvised for out-door gymnastics.

A word of caution, here, whilst on the subject of apparatus, will not be out of place. Before commencing any exercise on any instrument, the gymnast should carefully see that the apparatus is perfectly safe and properly fixed. This is more particularly necessary in the case of such instruments as the horizontal bar, and others which can be moved higher or lower to suit the wish of the performer. Many a serious accident has happened through a peg not being properly put in; and, indeed, all pegs should be so constructed as to allow of their being secured on the opposite side to that on which they enter, by having a hole in them through which a bolt may be dropped, and their accidental withdrawal or slipping thus effectually prevented.

One more caution before proceeding:—

Many of the exercises mentioned will severely tax the nerve of a pupil at starting. They should be practised with a mattress laid under the bars, if not in a regular padded gymnasium. A friendly hand placed under each shoulder of a timid pupil, to assure him of support in case his grasp fails him, will

speedily give him that degree of confidence which will enable him to successfully perform most, if not all, of the exercises. For similar reasons to those which counsel this assistance, all *practical joking* while exercises are being practised should be *carefully avoided*. The nerve of a boy may be permanently shaken and destroyed for these exercises, if such pranks are indulged in by his thoughtless companions. This caution is emphatic; boys will be boys, and there is a temptation to play a joke off upon a playmate when he is seen struggling in a *quasi-ridiculous* position; but let it be most distinctly understood that while there is no danger so long as the precautions above mentioned are complied with, there is real risk if the gymnastic practice is made an excuse for romping and horse-play. It degenerates into cruelty of the worst sort when a boy's nerves are made to suffer for the sake of an empty joke.

DRESS.

The best dress for all intending to take part in gymnastic exercises is the following:—

Tight-fitting elastic under-jersey, with short arms, to allow of perfect freedom of motion, a woollen "sweater" to put on over this when cold, or when standing waiting between exercises; white flannel trousers not cut too tight in the seat, and canvas shoes with indiarubber soles and no heels. If the trousers fit sufficiently well round the waist, and there is a buckle and strap behind, probably no belt will be required. Authorities are divided upon the question as to whether it is advisable to wear a belt or not; at all events, if worn, take care to keep the buckle well to the side, or, in circling the bar, it may sometimes catch.

THE HORIZONTAL BAR.

The bar should be fixed high enough from the ground to admit of the pupil hanging from it at full length, with feet just clearing the ground.

1. *Breasting the Bar*.—Stand facing the bar; now spring and grasp it with both hands, palms forward, thumb on same side as fingers; hang perpendicularly with legs close together and toes pointing downward (Fig. 1); now pull up with the arms until the chin tops the bar, lower slowly, and repeat the exercise without touching the ground as often as strength permits.

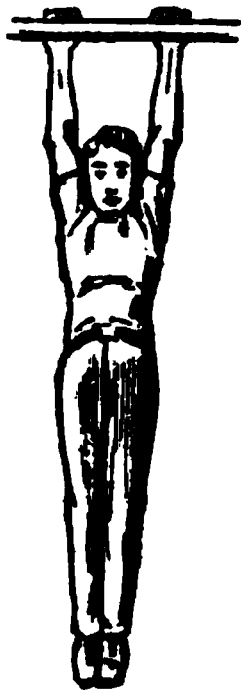


Fig. 1.

2. *Walking the Bar*.—These exercises will be found to bear a somewhat close resemblance to the marches on the ladder.

March 1.—Hang by the bar, hands parallel to each other. Pass one hand along the bar until the arm is fully extended, the main portion of the weight being borne by the other hand. Then transfer the weight to the other hand, and pass the rear-most hand up to the leader, and so progress to the end of the bar. Return, the other hand leading.

March 2.—Grasp, and advance one hand as in last exercise, but after obtaining hold with the leading hand, and loosing with the other, swing the latter arm past the body in the same manner as in March 4 of the ladder, and clasp the bar beyond the leading hand as far as reach can be obtained. The hand which has now taken the lead should clasp, facing the opposite direction to its fellow, and the body should have been swung round to face the other way, as the other passed to its new reach. Then quit with the hand that is now to the rear, and swing it



Fig. 2.

to a new reach, again turning the body to face the reverse direction to what it occupied just before, and grasping with the new leading hand in the same direction as the face, and the opposite to the grasp of the other hand (Fig. 2).

March 3.—Grasp the bar with hands facing each other, and clasping reverse ways. Bend the arms until the chin is above the bar, and the face looks along the line of the bar (Fig. 3). Then—

(a) Progress as in March 1, advancing the foremost hand to full reach, and then bringing the rearmost hand up to it, and so on.

(b) Extend the foremost arm and grasp, and then bring the rearmost over it (releasing it for the instant) to a new grasp in advance of it, and so on.

All these exercises should be performed alternately, left and right. They may also be varied by altering the position of the column of the body through the march. As described so far, the body is perpendicular. As convenient variations, it may be noticed that each march may be repeated with (1) knees bent at right angles, and rest of body perpendicular; (2) legs bent from the hip, at right angles, knees straight, trunk perpendicular.

3.- The Swing.—Stand about a yard behind and facing the bar, spring and grasp it, then swing backwards and forwards until the body acquires an almost horizontal position at the end of each swing. Come off the bar in the backward swing, so as to alight on the feet facing the bar; try this also in the forward swing, so as to come down with the back to the bar, though in this case on the hands leaving hold of the bar the body should be thrown well forward to counteract the tendency to falling backward.

In alighting from this or any other exercise come down well on the toes, yielding with the back and knees to save concussion. This hint is one which it will be well to bear in mind.

N.B.—Do not hang too long before dropping; it only sends the blood to the feet, and causes them to “sting” on alighting.

4. The Circle.—Hang as in Fig. 1, bend the body at the hips, head well back, and keeping the legs straight raise them till the feet top the bar, the shins touching it; then pull up with the arms, and so lift the body over the bar till it rests on the stomach. Straighten the arms, and rise into position as in Fig. 4. Descend by returning the way you came, reversing all movements.

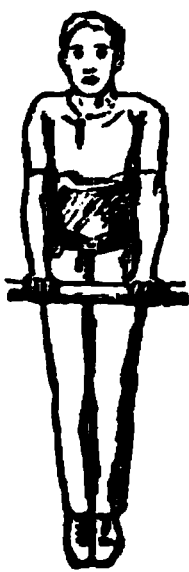


Fig. 4. (see p. 187). When the bar is thus mounted, the arms should rest on it, perpendicular and rigid.

b. Stand facing the bar, spring and grasp it. Give a good swing forward, and as the body comes back in the swing, kick out with the left leg and bring the foot over the bar, until the bar is caught by the bend of the knee. The body now hangs from the hands and bent leg; remove the left hand



Fig. 3.

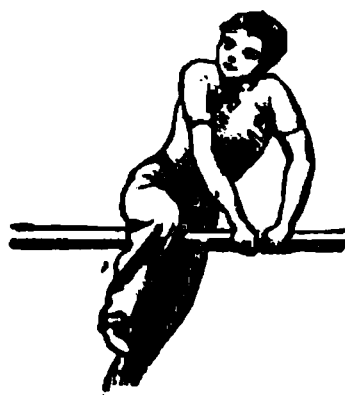


Fig. 5.

to the outside of the left leg, give a good swing with the right leg, keeping the arms stiff, and you will come up as in Fig. 6.

c. A neat way of doing this exercise is to hang as in Fig. 1, and either with a swing or otherwise bring one leg up through the hands and over the bar, and ascend into the sitting position astride the bar, as before.

6. Having now described the preliminary methods of getting on to the bar, it will be well to give a few exercises for the learner when there, before proceeding to some of the more ambitious climbs.



Fig. 6.

A. Circle the bar, as in 4, now rest the body on the bar, swing the legs well forward under it, and revolve under the bar so as to rise into the same position as before: the body will come up resting on the stomach. Having accomplished this, raise the body on the hands, as in Fig. 4, but with hands facing the reverse way—i.e., palms facing forward, knuckles downward—and giving the upper part of the body a good swing forward, with the arms rigid, revolve on the bar so as to come up into position on it again. This is much more difficult than the previous movement, and will need a lot of practice before it is acquired. Descend by half-circling the bar, that is, coming off in the middle of either of the two previous movements. Always endeavour to come off any instrument in a neat and effective manner; many exercises are spoilt by a slovenly finish.

B. Mount by the leg, and then with the body raised on the arms, one leg astride the bar, give the other leg a swing out behind, throw the body well back, at the same time catching the bar well in the bend of the knee, and with the arms stiff revolve into position again. This is called the *Backward Leg Swing*. Some difficulty will be found at first in so regulating the amount of swing as to be able to stop above the bar after one or more revolutions. Repeat on the other leg, and revolve several times without stopping, finishing above the bar, and descend by passing the leg back over the bar, and dropping.

C. *The Forward Leg Swing*.—Ascend as in the last, and when in position astride the bar, reverse the hands, raise the body well on the arms, and swinging the body well forward, come up under the bar into position again. This, like the *Forward Roll* treated of in A, is more difficult than the backward movement; but a bold plunge of the body forward, with a tight grip of the bar and the arms stiff, will soon carry one through both of the exercises. Repeat the exercise on the other leg, and descend as before.

All of these climbs and descents should be performed alternately left and right, one after the other, to equalise the play and capacity of either arm and leg.

7. *Exercises from the Sitting Position*.—Mount the bar by any of the previous methods, and when in position, with one leg astride the bar between the hands, sit on the bar, as in Fig. 7, by rapidly bringing the hanging leg up over the bar. The grip of one hand will have to be relaxed for an instant, to allow of the leg being passed under it; and there will at first be a tendency, when so doing, to fall

Fig. 7.

backwards; the pupil, however, can easily recover position again, by mounting by the leg. Once seated on the bar, then hold tight.

1. Incline the body backwards, with the legs close together, and fall back slowly head downwards; let the legs turn over the head (Fig. 8), and the body hang down, feet foremost, and so alight.



Fig. 8.

II. Reverse the hands and fall back slowly until the body assumes the position of Fig. 9, then lower the legs and so descend.

III. In either of the previous feats, after the body has fallen back, and before the legs are extended again from the loins, gather the knees to the chin, pass the feet under the bar, and descend with the toes pointing in the same direction as the fingers, and the body hanging from the shoulders direct, and not with the arms reversed, as in the two former variations of descent.

IV. *To resume the Sitting Position.*—Hang by the hands from the bar, as if about to circle it; bend the body at the hips, head well back, and arms stiff, raise the feet till they touch the bar, bend the legs, and bring them through between the hands by doubling up; straighten the body again, and you will be in a position something like Fig. 8, but with the legs vertical above the head; now pull up hard, and at the same time curl the body over the bar until the posterior rests on it, sweep the legs downward, and raise yourself with a bend of the body into the sitting position.

V. *The Muscle Grind.*—This is always a favourite exercise for boys, and its name, as beginners will find, is no misnomer. Sit on the bar, and gradually slide the body down in front, legs together, at the same time dropping the arms down behind until the biceps rests on the bar with the hands and fore-part of the arms hooked under it horizontally; now keep the fists close in to the sides, get up sufficient swing with the body to carry you round the bar, head forwards. You can then try to do this the reverse way, but you will find it much more difficult.

Fig. 2.

VI. *The Sitting Swings.*—These exercises are somewhat like the leg swings already treated of; but are much harder to perform, requiring as they do a large amount of nerve, and bringing into play to a much greater extent the muscles of the arms, and for them more than for any exercise yet mentioned it will be useful to have a friendly hand near, and a mattress beneath the bar in case of a fall. In the first of the following exercises, it is better to get up sufficient swing to bring one well round and over the bar, even at the risk of taking a half turn too much; as in the event of not having enough impetus to carry the body over the bar you must of necessity fall forward. Practice alone will enable the learner to calculate to a nicety the amount of swing required.

The Backward Sitting Swing.—Sit on the bar with the legs close together, grip the bar tightly with the hands, and raising the body slightly on the arms, throw yourself back boldly, and you will come up into position again—that is, after a few failures.

The Forward Sitting Swing.—Reverse the hands as in the forward leg swing, and supporting the body perpendicularly on the arms, swing the legs well back under the bar, at the same time throwing the body well forward, keeping the arms stiff, and come right round under the bar into the sitting position again. This is difficult, and it is necessary to stop on top of the bar, or you will fall forward.

8. *The Upstart.*—This graceful exercise is one which it will try the beginner's patience to the utmost to accomplish. It is of no use to give it up; because, until this method of mounting the bar is learnt, the pupil cannot aspire to even mediocrity in gymnastic studies, as nearly all the combinations of exercises commence with this climb. Constant practice is the only means of acquiring it; and as some solace to those disheartened after many efforts, we may say that the knack, for pure knack it is, will come all at once, and the reward of unexpectedly coming up on the bar will amply atone for many a previous failure.

Stand well behind the bar, spring and grasp it, pull up with the arms, and

dart the feet well out in front, so as to get up a good swing. As you come back drop to full length again; and now comes the difficult part. As the body comes forward again in the swing, bend well at the hips, bring the feet up to the bar, legs stiff, and then sharply lower them, at the same time pulling with straight arms. The effect of this sudden sweep or jerk of the legs downward should cause you to come up as in Fig. 4. At first there will be a tendency to come up rather askew; but soon you will be able to rise quite square with the bar.

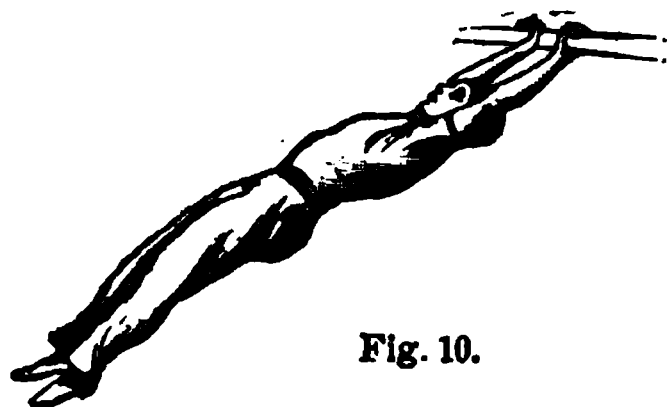


Fig. 10.

9. *The Clear Circle* from the ground. This requires more strength and agility than are usually found in boys, except in rare instances. Bend the arms at the instant of springing and clasping the bar, swing the body rigidly forward, shooting out the feet and throwing the head and shoulders well back, so that the impetus carries the body clear round without touching the bar, in a rigid posture, revolving on the hands, and so descending on the other side, as in Fig. 10.

The Clear Circle when in position on the bar (Fig. 4) is not so difficult as the preceding. Raise the body well on the arms, bending it slightly and keeping it well away from the bar, dart the feet forward and round the bar, revolving on the hands, with the arms stiff, and descend (Fig. 10).

10. *The Slow Pull Up*.—This is an amplification of the first exercise; but will require much more muscular power, as in that the chin only has to top the bar, whilst in this the body has to be brought above it. Grasp the bar with the wrists well over the top and thumbs underneath, now pull up hard; the difficult part will come when half-way through the exercise. Do not kick with the legs, but keep them stiff and slightly forward under the bar, and take care not to be satisfied with getting one elbow well up, and then with a swing of the legs scrambling up on to the bar; but stick at the exercise until you can pull the body up quite square with the bar.

11. *Hanging by the Legs*.—Hang from the bar with the hands, bring the legs up through them, and hook them over the bar, catching with the bent knees, let go with the hands and hang straight down; now give the body a gentle swing, and when nearly horizontal bring the legs down and alight on the feet. Have a friend at hand to assist you in this at first, or you may get a dangerous fall. As a finish to a series of exercises, the usual way of doing this exercise is to slide back from the sitting position on the bar, and so hang and off.

12. *Hanging by the Feet*.—Hang from the bar with the hands and bring the legs up as if to circle it, until the feet are hooked over the bar, then carefully let go with the hands, and lower the body gradually till it hangs head downwards at full length, the arms stretched out beneath. Come off by drawing up the body, and regaining position with the hands on the bar.

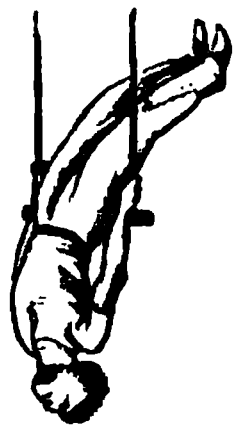


Fig. 11. — TRAPEZE—CLIMB 1.

THE TRAPEZE.

Many of the exercises on the trapeze are very similar to those on the horizontal bar.

The climbing exercises on it are performed both with the ropes and the bar, and with both combined, *e.g.* :—

Climb 1.—Face the trapeze, and grasp the ropes just above the bar; lift the feet from the ground; bend the knees to the chest, hanging the body from extended arms; pass the feet inside the hands and over the bar; extend the legs again as they pass over the bar, and hang the body well back,

until it lies across the bar, the latter in the middle of the thighs. Then slacken and lower the knees, pull up with the hands, raise the head and shoulders, and ascend into sitting posture on the bar, still grasping the ropes (Fig. 11).

Descend, reversing the actions in all points from end to beginning. These exercises may be facilitated at first by holding the rope a little higher than the bar.

Climb 2.—Grasp with one hand an arm's length above the bar; place the other on the bar, leaving sitting room between it and the rope held in the other hand. Raise the body by the two arms, till the one on the bar is straight. Then turn on the arms, and sit between them (Fig. 12).

Fig. 12.—TRAPEZE—CLIMB 2.

Climb 3.—Or rise in the same way, until the arm on the bar is straight. Then lift the feet, and pass them over the bar, and so sit down (Fig. 13).

Climb 4.—Hang by the hands on the bar; bend the legs from the hips, keeping the knees stiff; lift the feet till they top the bar, the shins touching it; then bend the arms, and so lift the body over the bar, turning over on the stomach, till the body lies across the bar (Fig. 14); then raise it with the arms, until they are extended downwards, and the body supported perpendicularly upon them. From this point there are a variety of continuations of the climb (Fig. 15).

Fig. 13.—TRAPEZE—CLIMB 3.

(a) Support the body on the arms; bend the knees, and bring them on to the bar; then raise each hand in turn for a higher grasp, until the ropes are held at arm's length above, and so rise into a standing posture, or else sit on the bar.



Fig. 14.—TRAPEZE—CLIMB 4.

(b) Change the grasp quickly with one hand to an arm's length above the bar on the rope, and so pass into the finale of Climb 3.

(c) Simply descend by lowering the body from the arms.

(d) Return the way you came, reversing all movements.

(e) Lower the body, to hang once more with arms full stretch and legs bent at the hips, and repeat the evolutions.

(f) Sit on the bar, as per version a or b; let the body hang back, the hands grasping firmly, until it lies horizontal, face upwards; then raise the feet and

Fig. 15.—VARIATIONS OF TRAPEZE—CLIMB 4 (a-g).

turn over, revolving on the hands, and so descend.

(g) Tighten the grasp of the hands, with the knuckles facing downwards; then fall forward, holding by the arms; lower the body gradually by them, and so descend.

These versions do not exhaust all the evolutions which can be added to vary the climb, when once the body is in a sitting posture on the bar, and is supported on it perpendicularly by extended arms. The ingenuity of the pupil will devise all sorts of combinations, when he has begun to master those which have been sketched, and to acquire nerve in practising them.

Climb 5.—Hold by the hands, and raise the feet the same as in Climb 4, but when the feet have reached the level of the bar, then, instead of passing the legs round outside the bar, bring the feet inside it, and pass the heels and calves and thighs in turn over the bar, assisting the motion by pulling the body up with the arms until it lies horizontal and face upwards, in the same position as in version *f* of Climb 4; then

(a) Turn over backwards (Fig. 16) as before, in version *f* of Climb 4; or



Fig. 16.—TRAPEZE—CLIMB 5 (a).

(b) Descend feet foremost, gradually lowering the lower limbs, keeping the head and shoulders well back to preserve the balance, and gradually contracting the arms until the body is supported perpendicularly upon them, the lower arm rigid, the elbow bent, the shoulder only an inch or two higher than the point of the elbow (Fig. 17). Then lower the body gradually by relaxing the arms, and so descend.

The several climbs so far described bring into play both legs and loins to assist the labour of the arms. Those which follow are hard arm work, and require more strength of arm, which, however, the pupil will soon acquire with practice.

Climb 6.—(a) Hang by the arms, lift the feet from the ground; bend the arms until the breast-bone is level with the bar. Then pull strongly with one arm and press with the other, raising the elbow of the latter until the fore-arm rests perpendicularly on the bar. Then bring the other arm into the same position; then straighten both arms, raising the body into the posture which concludes Climb 4, whence any of the variations of that climb may be appended.

(b) This should be repeated left and right, the arm which bends and rises first in one case being the last to come over the bar in the other.

(c) Hang, and bend the arms as before, till the breast reaches the bar. Then bring both arms simultaneously over the bar, and ascend as before.

So far the exercises have been confined to one bar. If the trapeze can be enlarged at will to a perpendicular rope-ladder by movable "rungs," the ladder may be climbed

(a) By lifting the body step by step, with one arm at a time, and then similarly lowered (Fig. 18); or

(b) By bending both arms till the knuckles are level with the lower part of the shoulder; then spring with the arms, by a strong pull downwards, and extend them at the same time to catch the bar above, and so ascend one bar after another (Fig. 19).

Fig. 17.—TRAPEZE—DESCENDING FROM CLIMB 5 (b).

Fig. 18.—CLIMB (a) ON THE ROPE LADDER.

Fig. 19.—CLIMB (b) ON THE ROPE LADDER.

EXERCISES WITH A PAIR OF RINGS.

These exercises strengthen the arms and wrist more than any other portions of the body, but they help to

impart a certain amount of general activity to the loins and lower limbs as well.

Climb 1.—(a) Grasp the rings, knuckles facing the body, and hang by the arms; raise the feet from the ground, stiffen the knees, and bend the loins, till the legs are horizontal with the ground, then bring the feet over between the hands, hanging the head and shoulders well back, turn over, still holding tight with the hands, and so descend (Fig. 20).

(b) Return with reverse motions to the positions whence you came.

Climb 2.—(a) Hang as before; bend the arms as in Climb 1, till the breast is level with the rings. Then press with one arm, and pull strongly with the other, till the first-named arm is raised with the elbow over the ring, and fore-arm extended downwards. Bring the other arm to the same position, the body then being supported perpendicularly on the fore-arms and the elbows bent. Then straighten both arms (Fig. 21).

(b) Repeat, alternating the action of the arms, left and right.

(c) Rise as before, till the arms are bent. Then raise both arms simultaneously, and so attain the vertical position.

After each of these exercises descend by reversing the movements.

Climb 3.—(a) Revolve as in Climb 1; but at the conclusion of the revolutions, instead of quitting hold of the rings, raise the body as follows.—Lean to one side, elevating the farther shoulder; press downwards with the arm on the elevated side; raise the elbow till the fore-arm is vertical; follow suit with the other arm; the position is thus the same as in Climb 2, and the exercise can be so continued.

(b) As in the preceding exercise, revolve as in Climb 1; then press downwards with both hands and elevate both elbows at once, till Climb 2 is attained.

(c) Having attained this position, either by forwards or backwards climb (2 or 3), lower the head and shoulders, and bend the arms at the elbow, keeping the fore-arm rigid; raise the legs behind, or the inclination of the head and shoulders forward will afford the balance, until the body is supported vertically, head downwards, upon the fore-arms, the elbows being bent and hugging the body. Descend by relaxing the rigidity of the loins, lowering the legs in the direction of the face, raising the head and shoulders, and so reach the ground (Fig. 22).

(d) Having elevated the body to rest vertically on the rings, with arms fully extended, let it slowly be lowered, keeping the arms rigid, but letting them extend wider from the body, pressing strongly with both hands evenly, until the arms are at right angles with the body. To retain the body for any duration of time in this position requires more strength of arm than any of the other above-mentioned feats. When the horizontal with the arms has been attained, and has been maintained so long as the pupil's powers will allow, slowly relax the rigidity of the shoulders, and continue the descent, until the body swings suspended by the arms. The outward pressure of the arms upon the rings must be but slowly relaxed, so as to make the descent gradual (Fig. 23).

These general exercises on rings will, when once mastered, suggest of them-



Fig. 21.—
RINGS EX-
ERCISE—
CLIMB 2(a).

Fig. 20.—RINGS
EXERCISE—
CLIMB 1(a).



Fig. 22.—
RINGS
EXER-
CISE—
CLIMB
3(c).

selves to the pupil other variations and combinations of the several movements already described. To exhaust all these in detail would take up too much space. It will be found that the same positions occur at intervals, over again, in various feats, and from these points the ingenuity of the pupil will suggest the transfer from one exercise to the other.

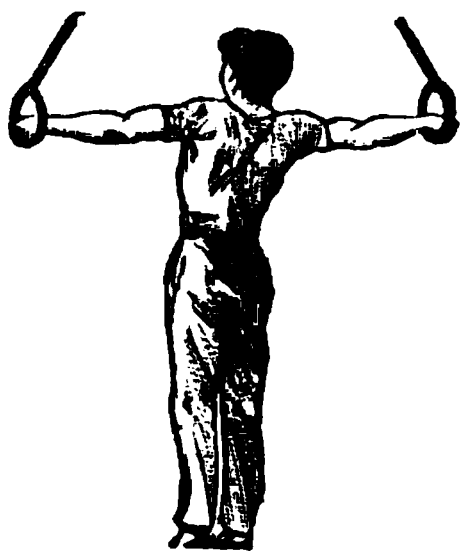


Fig. 23.—RINGS EXERCISE—CLIMB 3 (d).

A Row of Rings.—In a fitted gymnasium a row of rings is often hung, and it is fine exercise to progress along them by swinging from one to the other thus:—Swing by one hand from one ring, taking a spring from the feet; catch the next ring as the oscillation reaches it, and, holding both rings in the swing back, keep the front arm stiff and pull with the back arm; when this return swing has reached its full length, leave the ring first grasped, and swing forward, holding by one hand only, on the second ring,

until the oscillation brings the third in reach, and so on. The arm which quits the ring left behind should be dropped at once, and swung well round the body and forward, in the direction of the next ring to be grasped; the weight of the released arm, as it thus swings past the body, aids the progress of the body and the entire oscillation (Fig. 24).



Fig. 24.—WALKING THE RINGS.

EXERCISES ON PARALLEL BARS.

The use of this apparatus is to strengthen the extensor muscles of the arms and shoulders, and the pectorals, and to produce activity, though not necessarily strength, in the loins and lower limbs.

A pair of bars should be about ten feet long, and should be of such height.

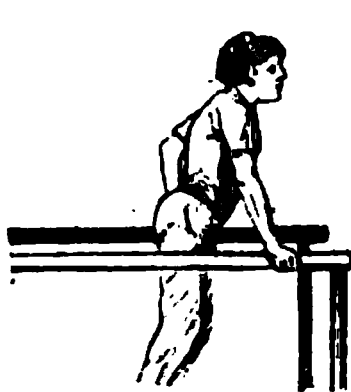


Fig. 25.—SINGLE PROGRESSION FORWARDS.

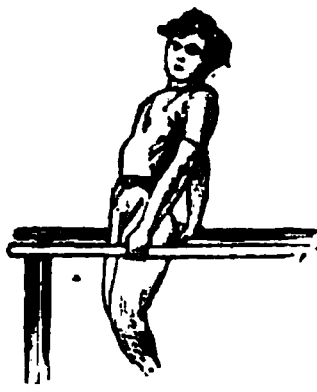


Fig. 26.—SINGLE PROGRESSION BACKWARDS.

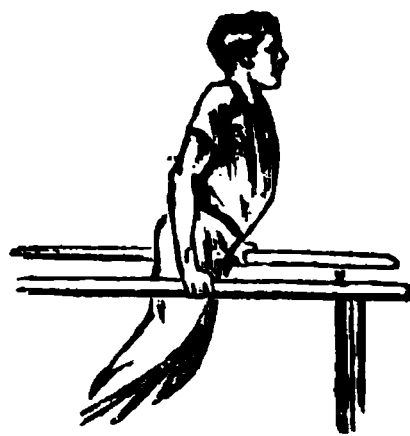


Fig. 27.—DOUBLE PROGRESSION FORWARDS.



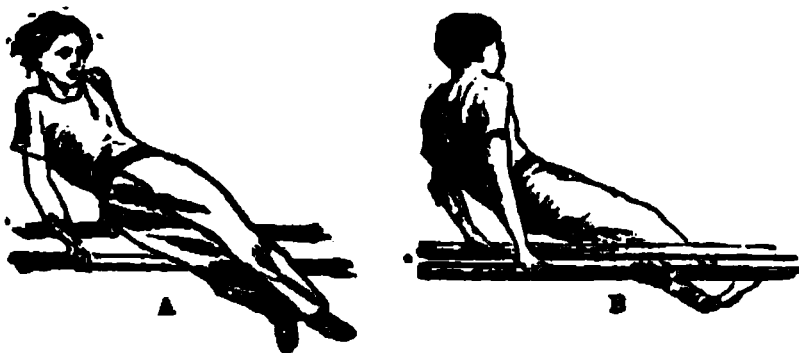
Fig. 28.—DOUBLE PROGRESSION BACKWARDS.

that when the elbows rest on them the feet are clear of the ground. They should be one foot eight inches apart (for boys). The pupil commences by standing between them, placing a hand on each bar, and raising himself by a spring from the feet until he is supported by his arms fully extended downwards. Once on the bars, a variety of exercises are open to him.

1.—*Single progression*, which consists in “walking” along the bars with alternate hands resting as much weight as possible upon one hand, while the other “jumps” its step, and then *vice versa*. This can be done both forwards

and backwards (Figs. 25, 26). When well mastered the "step" of each hand should attain a length of six inches.

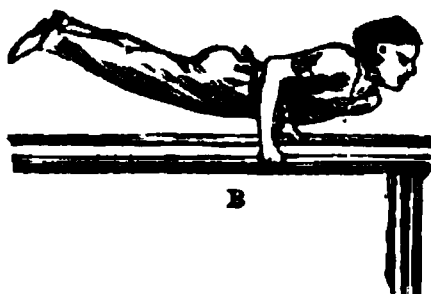
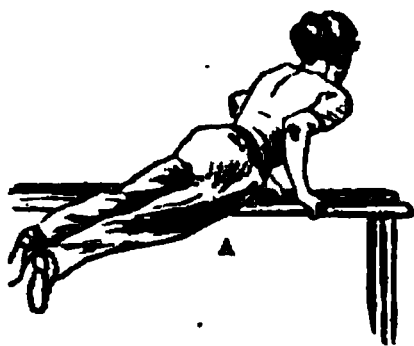
2. *Double progression* is entire "jumping" with both hands at the same time, and like its predecessor can be performed both forwards and backwards (Figs. 27, 23). The arms should be kept rigidly parallel to each other, and the "jump" effected by pressure with wrists and hands on the bar, and spring from elbows and shoulders. If one hand takes a longer spring than the other the body is thrown out of its place, and does not fall in the direction required.



Figs. 29, 30.—CLEARING THE BARS FORWARD TO RIGHT (A) AND TO LEFT (B).

To facilitate the spring, *bend the knees*, sticking the feet and lower legs out behind, at right angles to the body. This throws the weight more on to the palm and bases of the fingers, and aids the elasticity of the spring.

Double progression is also done by lowering the body between the bar until



Figs. 31, 32.—CLEARING THE BARS BACKWARDS, TO RIGHT (A) AND TO LEFT (B).

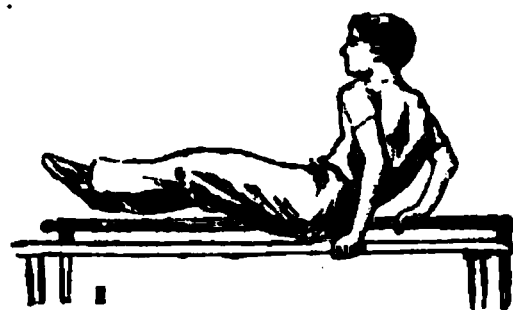


Fig. 33.

the arms are bent at right angles to the body, and then proceeding in a series of hops as before, keeping the arms bent.

3.—*To Clear the Bars Forward.*—Raise the legs until they are extended at right angles to the body; turn them sideways over one or other bar, lower them slightly, and at the same time throw the body clean over the bar by a strong pressure from the outside hand. Practise this both ways, to right and to left (Figs. 29, 30). The elevation of the legs may at first be assisted by getting up a

swing with them, but as the arms gain in strength, the pupil should be able to lift his legs without swing, and by sheer pressure of the hands and rigidity of arms and back.

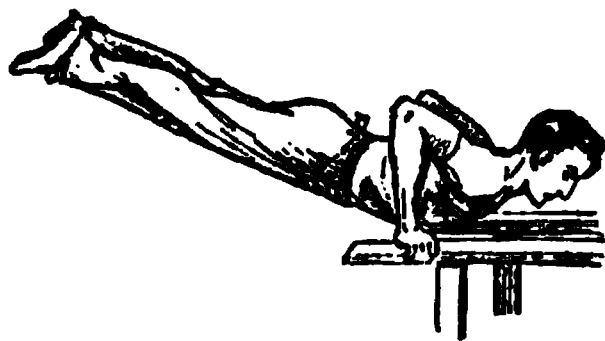


Fig. 34.

4.—*To Clear the Bars Backwards.*—This is not quite analogous to the forward process, because the legs cannot bend back from the hips at right angles to the body, so the arms instead must bend. Keep the forearm still upright on the bar, bend the elbows, and incline the body forward over the arms till it

makes a letter T, the arms forming the upright and the body the lateral stroke. Then pass the legs over one bar, and spring as before from the outside hand, to throw the body over. This should be also done both to right and to left (Figs. 31, 32), and, like its predecessor, may be commenced with a swing to aid the elevation, though in time the pupil should be able to do it by sheer force of arms and loins.

These are the main exercises for parallel bars, but varieties may be added:—

(a) Sit on one bar, hold the bars as before, raise the body on the hands, swing the legs over between the bars, and then over to the other side, and so alight (Fig. 33).

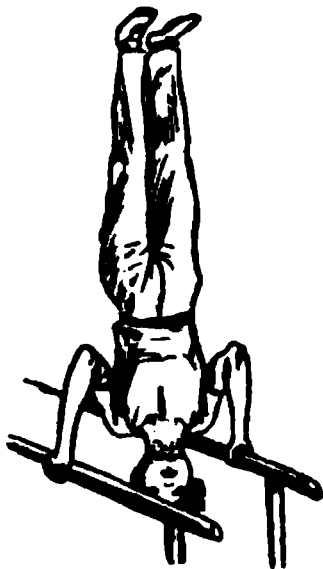


Fig. 35.

(b) *The Pumps, Forward and Backward.*—These exercises are specially good for strengthening the muscles of, and expanding the chest. For the *forward pump* get into position on the bars, about a foot from the end, then swing the feet well forward, and when at the end of the backward swing, the body is nearly at right angles to the arms, bend and lower the arms so that the chest is almost level with the bars (Fig. 34); and as the legs swing under and forward again, straighten the arms and rise into position. The *Backward Pump* is done by dropping with the arms in the backward swing, the reverse of the previous exercise. The two exercises combined are very effective.

(c) Bend the arms as in Exercise 4, bring the body over until it is vertical, head downwards, then throw off with the outside hand and alight, landing on the feet. In order to attain this upright position, lift the feet in front, legs extended, till the toes are as high as the face, not higher, then swing them back, and with this impetus and the pressure of the hands, raise the body vertically (Fig. 35).

(d) Again, sit on one bar, or astride of the two, hands as before, the legs behind the hands. Let the head and shoulders fall forward, and at the same time extend the legs and bring them round off the bar, until the body rests upright on the arms (Fig. 36); then descend as before. It is important to remember that all these exercises should be performed alternately left and right. This last exercise may be reversed—i.e., let the hands grasp the bar behind the body, then elevate the legs with a swing



Fig. 36.

to the rear, then lower them with a swing under the body and to the front and again swing to the rear, up to the level of the bars, and clear the latter, and so alight (Fig. 37).

The perpendicular to the rear may be attained with the arms only, which must be kept perfectly straight; it requires, however, far more strength in the exterior muscles of the arm and in those of the grasp than any of the previously mentioned feats. This can be done by either raising the body by the extension of the arms, or by a swing from the front, the feet having been first elevated as high as the face, so as to give impetus to the swing.



Fig. 37.

When once the body is poised thus perpendicularly, "single progression"—described above, by moving one hand at a time along the bars—may be practised both forwards and backwards (Fig. 38). In so doing the rigidity of the body must be strictly preserved, by stiffening back, loins,

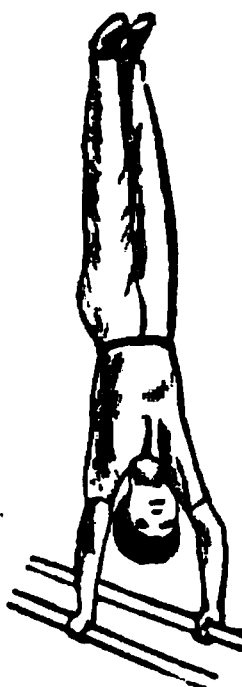


Fig. 38.

and knees, so that the weight may fall perpendicularly upon the hands, and the latter must grasp with all the force in the pupil's power, far more than in ordinary progressions with the head uppermost. It will have been noticed that in many gymnastic exercises the natural position of

the body often has to be inverted—the performer, that is to say, must frequently place himself upside down. Boys must be cautioned to use the utmost care in going through such exercises, as the least carelessness might be attended with the most serious results, and beginners should always have a friend at hand in case of a slip.

THE HORSE.

The series of exercises on this instrument are very effective, and especially useful for strengthening the muscles of the wrists, and in giving *spring* and agility to the whole body. The vaulting exercises on the horse will often come in useful in every-day life, as many a rail or gate, too formidable to be cleared by a running jump, can be overcome by vaulting.

The apparatus is composed of a block of wood covered with leather, somewhat in the shape of a horse's body, standing on four legs, which are frequently made telescopic, so as to permit of the *horse* being adjusted to the requisite height. For the simple vaults, the plain trunk is sufficient as shown in Figs. 39, 40, 41; but for the more elaborate exercises it is necessary to have a saddle in the centre composed of two pommels about 18 inches apart, which can either be made fixtures, or, as in most gymnasia, movable at will.

1. Spring into position as in Fig. 39, hands about eighteen inches apart; now support the body on the arms, and spread the legs out left and right several times, then descend and spring up and down sharply, taking care to alight on the toes.

2. *Vaulting in Three Motions* (Fig. 40).—Stand in front of the horse and spring into position as before. Then raise one leg, still rigid, till it rises level with the horse; rest the hollow of the foot on the horse, bring the other leg up under the other in a similar manner, except that the *outside* of the instep will in this case pass over the horse, but will not touch it; then clear the horse with both feet by a spring from the foot which rests upon it, and descend on the other side.

Fig. 39.

Fig. 40.

3. *To Vault in Two Motions* (Fig. 39).—Spring and rest on extended arms, as before; then with a strong downward pressure of the wrists and swing of the legs from the hips, throw the legs clear over the horse, and descend as before.

4. *To Vault in One Motion* (Fig. 41).—Grasp as before; spring simultaneously with feet and with pressure of hands and extension of arms, swinging the legs to the side, and clearing the horse without touching it with anything but the hands.

Fig. 41.

N.B.—These exercises are best practised on alternate sides—i.e., vaulting to right and left alternately. If the pupil begin thus, he will vault with as much ease on one side as the other; but if he commence with mastering the vault on one side only at first, he will acquire a habit and bias in that direction, and will find far more difficulty in subsequently mastering the vault to the other side. In practical vaulting over gates, &c., it often happens that the obstacle admits of a vault only on one side, hence the value of learning both movements.

For the following *Saddle Exercises* the pommels will be required, and, indeed, the vaults can be done equally well on them. For these it is necessary to have an inclined board in front of the horse, rising to a height of about three inches, and in size about a yard square, from which the learner can spring off.

5.—Grasp the pommels and spring into position as before; now lift the right leg sideways, and bringing it forward over the horse, raise the right hand for a moment and pass the leg under it into the position of Fig. 42. Return the leg the same way, repeat the exercise with the left, and descend.

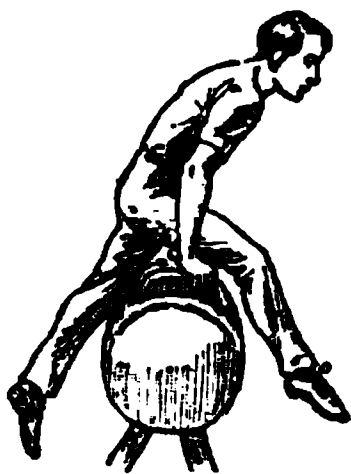


Fig. 42.

6.—Pass the leg over as in the last, but in one motion—that is, with a spring from the board; when one leg is between the hands bring the other forward, too, and return by drawing up the knees to the chest and passing the legs back between the hands. It is rather difficult at first in this movement to raise the feet high enough to clear the horse on their way back.

7.—This exercise requires some nerve, but if gone at with confidence and a good spring is very easy. It will be well, however, to have a friend on the farther side of the horse to catch you if the feet should happen to touch and so throw you forward. Take a short run, and with a good jump off the board, as the hands grasp the pommels bring the legs up between the hands as in Fig. 43, and then darting them out in front alight on the feet on the further side with the back to the instrument.

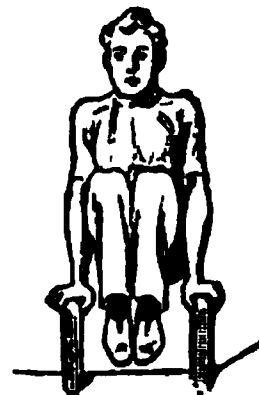


Fig. 43.

8.—Stand in front of the horse and grasping the pommels, spring into a kneeling position between them; now raise the arms up, and giving a good spring forward, descend on the feet on the opposite side. The difficulty at first when in the kneeling position is to get "the good spring" spoken of; but the swing of the arms will assist greatly.

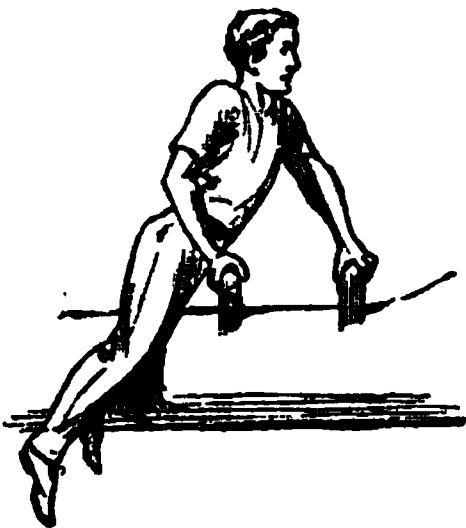


Fig. 44.

9.—Vault into position as in Fig. 44; now rest the body well on the arms, and raising the body with a swing to one side, descend astride the horse on the opposite side of the saddle, facing the reverse way to that you started from.

10.—Same as the preceding, but descend facing the way you started from, and so off at the opposite end of the horse.

There is a variety of other exercises of a similar character, which the ingenuity of the pupil will soon discover for himself.

11.—This is a difficult exercise to finish with, and great care must be used in attempting it; it is similar to Figs. 35 and 36 of the Parallel Bars, and should not be practised without friends at hand.

The position is the same at starting as in the other exercises; but the legs instead of swinging round the body as in the previous vaults, rise over the head in a straight line into the position of Fig. 45, with the elbows hugging the ribs. Now straighten the arms until the body rests perpendicularly on them, and throwing off with the hands descend on the feet. The illustration shows the exercise without pommels; but it will be found easier to practise it with them.

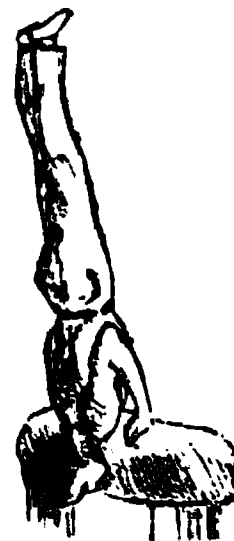


Fig. 45.

CLIMBING.

The practical use of all gymnastic feats in trapeze or horizontal bars, and such-like apparatus, is to enable the pupil to climb, and to overcome obstacles in the way of climbing. In the ordinary process of climbing a tree, the several exercises of surmounting the horizontal bar, climbing the plank, and such like, will occur for practical purposes; and the pupil will then find the real benefit of his previous practice. But, over and above these details of climbing, there are others in which no horizontal support is offered to the grasp, or horizontal rest for the feet. In these cases the support has to be found in the grasp of hands or feet, or both, upon a vertical or inclined surface. This species of climbing is what is generally known by boys as "swarming," and is performed on any vertical or inclined eminence, destitute of horizontal support, such as a pole, a rope, or a spar or mast.

Climbing the Mast.—The grip and action of the hands may be varied in mast climbing, as will be seen below. The grip of the legs and feet admits of no variation, if the legs are to be used at all. It is assumed that the mast is of

ten inches and upwards in diameter—too great to admit of the feet clasping it as in pole or rope climbing, of which more anon. The support from the lower limbs must therefore be attained by using both legs and feet to complete the grip.

Position of the Legs. *Climb 1.*—Stand in front of the mast, and throw the arms round it. Lift one leg and place the inside of the knee against the mast, and bring the other leg round the mast on the side nearest to the body, the "shin" bone of the leg lying diagonally downwards, the foot extended, and upper instep pressing the mast (Fig. 46). Throw the other leg round the mast, the inside of the calf and the heel pressing the farther side of it. The mast is then nipped between the two legs, and the two heels are at about the same level, but the toe of the outside leg points out from the mast at right angles, while the toe of the inside leg points diagonally downwards. The legs then have their own independent grip, and alternate with the hands in elevating the body.

Position of the Hands. *Climb 2.*—Place one hand above the other. The uppermost hand should correspond with the leg which clasps the mast on the farther side from the body. Then hug with the arms and relieve the legs of the weight of the body, hang the head well back, draw up the legs till the knees are almost or quite level with the hips, then clasp again tightly with the legs, and relieve the hands somewhat. Loosen the lower hand and pass it above the other, take a new grip, and draw the legs up still higher; then pass the lower hand again to the top as before, take a new pull, and so progress (Fig. 47).

Climb 3.—Interlace the fingers and embrace the mast tightly. draw up the legs, grip with them, and so relieve the arms of the weight; shoot both arms together upwards, still retaining (Fig. 48) the interlacing of the fingers, and take a fresh hold, and so on.

Climb 4 is somewhat similar to the last, except that the hands grasp

Fig. 46.—GRIP
OF THE MAST—
CLIMB 1.

Fig. 47.—CLIMB-
ING THE MAST
—CLIMB 2.

Fig. 48.—
CLIMBING
THE MAST—
CLIMB 3.

differently; the hand which corresponds with the leg which clasps on the outside should clasp over the fingers of the other hand, and the tips of the fingers of the uppermost hand should nip upon the edge of the forefinger and part of the thumb of the lower hand; the little finger of the upper hand coming close up to the thumb of the lower, and the latter nipping the tips of the fingers of the upper hand, between the thumb and ridge of the forefinger.

Climb 5 — The grasp of the hands is the same as in *Climb 2*, but the legs give no support, simply slung astride of the spar. Shoot up the hands quickly, still pressing the surface of the mast as they rise, and then clasp anew, and draw the body up still higher.

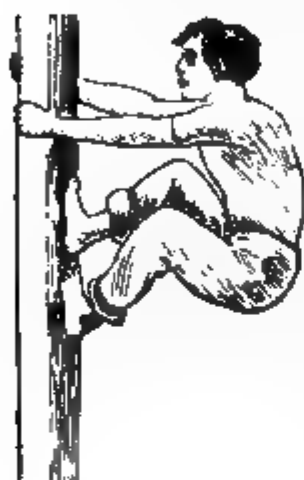


FIG. 49. — WALKING THE MAST.

Except for general strengthening of the arms and grip, the last climb is of little use except as an exhibition of power, for unless a climber has lost the use of his lower limbs, he can always get a good grip with his legs to aid his hands.

WALKING THE MAST.

This is not unlike walking the plank with hands and feet, and is a by no means easy method of ascending the mast, inasmuch as it requires greater strength of grip of the hands than the preceding methods of climbing. At the same time, it is the speediest of all the modes of ascending the mast. It must be performed barefooted. The grasp of the hands is the same as in *Climb 1* of the mast; but the chest does not hug the mast, and the feet being pressed against the mast with knees slightly bent,

create sufficient counter pressure to the grasp of the hands, to give the necessary support.

The pupil then walks straight up the mast, holding his head well back, and keeping his back stiff and flat, and his eyes upwards. He raises each hand in turn one above the other, and raises at the same time the corresponding foot an equal distance up the mast, and so advances (Fig. 49).

The descent of the mast in all these several climbs may be performed by simply reversing the action of ascent: but the more rapid and convenient descent is by clasping the mast with both arms and legs, and sliding gradually down, the head thrown well back, and the speed of descent regulated by the amount of grip retained on the mast.

POLE CLIMBING.

The process in this is similar in its several marches to that of mast climbing. The difference lies in the grip of hands and feet. On the mast arms or legs clasp, or both; on the pole hands and feet give the hold, the diameter of the pole admitting of it.

FIG. 51 —
STANDING
ON THE
POLE.

The grip of the hands requires little or no detail; simply each should hold, one above the other, palms facing each other.

The Grip of the Feet is obtained thus (Fig. 50):—Lift one foot, and place the instep diagonally across the inside of the pole, the toe pointing in the direction of the other leg, and downward; lift the other leg, and bring it round the outside of the pole, so that the tendons above the heel

FIG. 50. — GRIP
OF POLE.

press against the pole. The latter is thus nipped between the instep of the inside foot and the heel tendons of the outside foot.

The grip of hands and feet thus secured, *vice* that of arms and legs, the pupil can go through much the same series of marches as those which he practises on the mast, namely :—

Climb (a) With both hands and both feet alternately ;

(b) With alternate hands, raised above the other, and last with feet raised simultaneously ;

(c) With hands above, the feet merely steadying and guiding the body to the line of the pole, but not gripping it.

The pupil cannot “walk” the pole in the same way as he does the mast, the diameter not admitting of footing for the feet with any safety.

He should practice “standing” on the pole (Fig. 51), with body erect and chest leaning against it, supporting himself solely by the grip of his feet. This helps to teach him the proper method of holding the pole firmly between his feet. He may, when he has acquired this power, climb the pole with one hand only, the feet taking their turn to support the body while the one hand is extended for a new reach, but the other arm hanging perpendicularly by the side. This should be practised alternately with either hand.

ROPE CLIMBING.

A fixed vertical rope, taut at both ends, is climbed in the same manner as a vertical pole, and is the easier of the two to ascend, because the roughness of the rope gives better hold to hands and feet. The rope is sometimes knotted at even intervals in a gymnasium, and these still further facilitate the hold upon it.

An inclined rope, taut, is climbed by hanging upon it in a position similar to that on the horizontal bar before dropping from it, *i.e.*, body hanging backwards, face to the rope, hands grasping the rope, legs swung round it, the hands then progress alternately, and the legs follow.

THE VERTICAL LOOSE ROPE.

This requires far more skill and nerve to climb. The swaying of the rope, and its tendency to revolve, help to puzzle the pupil, and to make him forget where he is when he attains an elevation.

The hands work the same way as on the vertical pole.

The feet may be used in the same way as on the vertical pole, *i.e.*, simply gripping the rope between the instep of the inside foot, and the heel tendons of the outside one (Fig. 52).

Thence the same exercises may be gone through as on the vertical pole, with the exception that the swaying of the rope will make it unsafe for the pupil to attempt to “stand” on the rope unassisted by his hands, in the manner recommended for practice on the vertical pole.

THE STIRRUP LOOP.

The Stirrup Loop is another and more secure method of using the feet when rope climbing. A rope is probably of much smaller diameter than a pole, and so affords less substance for the feet to grip in the manner described for pole climbing. But the stirrup loop obviates this, and when once well mastered gives a hold to the feet, which is more secure than that of any other branch of “swarming.”

The loop is gained thus (Fig. 53): Lift one foot from the ground and place



Fig. 52.—
CLIMBING
THE VER-
TICAL
LOOSE
ROPE.

it against the rope, in the same manner as the commencement of the grip for pole-climbing—i.e., diagonally against the rope on the inside, the rope lying against the instep. Then bring the other foot under the rope, lift up the end, bring the coil round the hollow inside of the first foot, and on to the instep. Then stand with the second foot on the instep of the first, firmly pressing the rope down on the instep of the first foot. The latter then is in an impromptu stirrup. The stirrup, once formed, may be carried up with the feet: the feet relax, when their turn comes to rise, sufficiently to let the rope pass through them, and at the same time the rope is always retained, lifted by the instep of foot No. 2 under the hollow of foot No. 1. The foot in the stirrup is raised to its new position, the other foot then slips the "slack" of the rope, and also takes up a new position, and when the hands have attained their new reach, the rope is nipped afresh between the feet, and the stirrup tightened again for fresh support for the legs.

Fig. 53.—
FOOT IN
STIRRUP
LOOP.

In descending a rope too much care cannot be taken to prevent the descent from being too rapid; else the friction of the rope may seriously cut and scorch the hands. It is better not to slide with the hands, but to bring them down one over the other in the same way that they ascended. The hold of the feet should be retained, with sufficient pressure to assist in regulating the descent; and the stirrup will retain its form, and will slip easily between the feet as required.

THE HORIZONTAL BEAM.

A smooth beam, like a ship's spar, laid horizontally, affords many gymnastic exercises. It should stand about three feet six inches from the ground, and should be about a foot in diameter.

To Mount the Beam.—To commence with, mount it in a manner similar to "vaulting into the saddle."

Fig. 55. MARCHING ON
THE BEAM, BACK-
WARDS.

To March on the Beam—(a) Mount, then place the hands in front, and lean the body well forward till the centre of gravity is over the hands; press on thus till the body is lifted off the seat, and it will then swing forward until over the hands, then lower the body to a sitting position, and repeat until the march forward has extended the length of the beam (Fig.



FIGS. 56, 57. - MARCHING ON THE BEAM
(BODY RAISED); FORWARDS (A), BACK-
WARDS (B).



Fig. 54. MARCH-
ING ON THE
BEAM, FOR-
WARDS.

54). Then reverse the action and march backwards, placing the hands under the thighs, lifting the body, bending forward until the hips swing away backwards from the hands, and then lowering to sitting posture again, and so on (Fig. 55).

(b) This march may next be attempted with the hands only, the body not sitting down at all, but balanced on the hands. The hands then step forward, one at a time, and bear the body with them. The same exercise can be repeated backwards (Figs. 56, 57).

(c) Next, keep the same posture, but progress in springs; both hands should

be together, and each step should be "jumped" by the spring of the arms and wrists; the exercise may be repeated backwards.

(d) Similar exercises of bearing the body with the hands along the beam, either sitting down between each step, or keeping the body solely upon the hands and moving with alternate hands, or with both, simultaneously in a spring, may be practised with the body in a lateral posture, sitting over the beam as on a chair, instead of astride of it (Fig. 58).

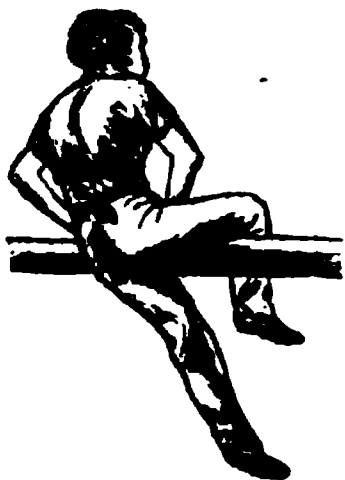


Fig. 59.—MOUNTING THE BEAM WHEN TOO HIGH FOR VAULTING.

To mount the beam, when it is too high for vaulting (Fig. 59):—Stand underneath it, spring and clasp the hands round it, swing the legs, and throw them also over the beam, the body hanging back downwards from arms and feet. Then carefully detach one hand, keeping the palm of the other tightly pressed on the beam for support, and pass the loosened hand rapidly round over the beam; at the same time lower the leg which corresponds with the detached hand, and swing it back with sufficient force to raise the breast on to the beam; press with the hands and remaining leg, passing the latter over the beam as the body rises, and so lift the body with a sitting posture astride of the beam.

To descend (Fig. 60): bend forward and clasp the hands firmly under the beam; contract the legs and cross the feet under the beam, incline to one side or other, and revolve, till the body hangs by hands and feet, as it did in the early stage of mounting the beam. Then let go with the feet, hang a second from the hands, and then drop.

LADDER CLIMBING.

An ordinary ladder leaned against a wall, and securely propped at its base, also gives much the same exercise as the trapeze ladder, and can be climbed to strengthen the arms, thus:—

Hang under it, grasp a rung at full reach from the ground with both hands. Thus:—

(a) Climb with both hands and feet in same way as if the ladder were climbed in the ordinary manner with face foremost.

(b) Hang by the arms only, and march one hand a rung higher; then bring the other to the same rung, and so on.

(c) Reach the hands alternately above the other, and so progress.

(d) Ascend both hands simultaneously, springing with the arms by contracting them, and then taking a new grasp a rung higher than the last. Descend in either case, either by reversing the action or by sliding the hands down the perpendiculars of the ladder. The legs may be swung and clasped round the ladder, to aid the support and (note this as a useful hint) to ease the friction of the hands.

A HORIZONTAL LADDER.

This is a common apparatus in a fitted gymnasium, but any strong ladder laid horizontally across two beams, eighteen inches more from the ground than the height of the pupil, gives good practice for this sort of exercise.

March 1.—Spring from the ground and grasp the end rung of the ladder with both hands, facing to the farther end of the ladder. Hang with arms fully

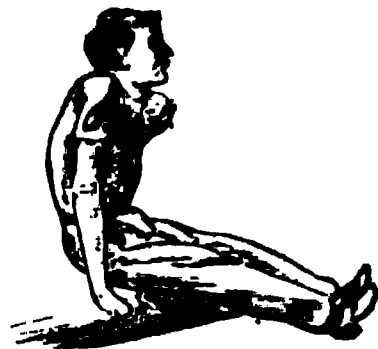


Fig. 58.—MARCHING ON THE BEAM: BODY PLACED CHAIRWISE.



Fig. 60.—REVOLVE IN THIS POSITION.

extended and body perpendicular. Loose one hand and grasp the next rung; then bring the other hand to it; and so on.

March 2.—Commence as before, but instead of bringing the hindmost hand only to the rung already occupied by its fellow, pass it on to the next rung beyond; and so on.

March 3.—Hang by both arms, bend them, and (with a strong pull downwards before quitting hold of the rung) spring with the arms, loose the rung, and grasp the rung beyond; and so on.

Each of these marches may be varied by omitting one or more of the intervening rungs at each "stride."

March 4.—Hang as before with both hands; oscillate the body by swinging

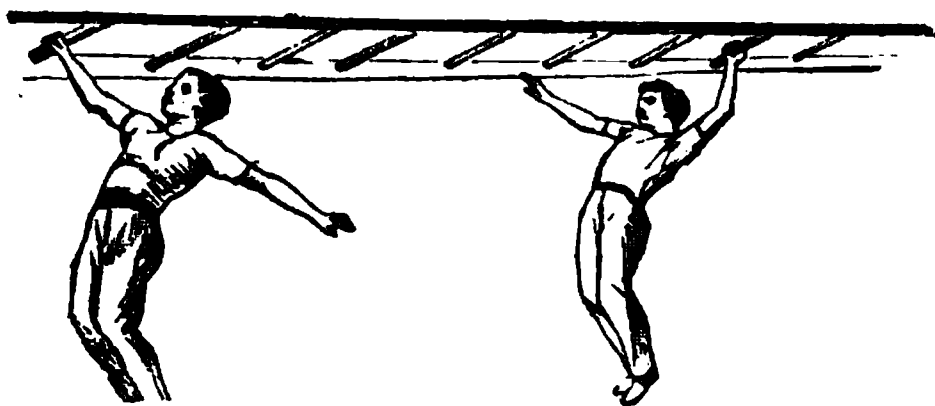


Fig. 61.—WALKING THE LADDER.

the legs, until a good swing is attained. Then in the swing forward loose one hand and reach forward with it, grasping the next rung as far in advance as reach and seeing will permit. Hang for an instant by extended arms; then throw off with the hindmost arm, pull sharply with the arm extended forward, and aid the swing by bringing the loosened arm full length past the side and

in advance of the other arm; grasp anew as far ahead as possible, and repeat to the end of the ladder (Fig. 61).

In some gymnasia the ladder is elastic—made of wire rope—and this greatly aids the swing and oscillation; but any ordinary ladder, laid horizontally, possesses a certain amount of spring, which facilitates the exercise.

In time, especially when practising on an elastic ladder in a gymnasium, the pupil will be able to increase his "stride" in March 4, by actually quitting hold with the rearmost hand before he clasps with the foremost. He thus covers a longer reach than he could with the simple extension of arms, when one of the two is always holding a rung.

THE INCLINED PLANK.

The plank should be about a foot or more in width, and its angle with the ground may be varied; but 45° is the best angle for ordinary practice. The edges of the plank should be slightly bevelled off to prevent the plank from cutting the hands when holding it.

The plank may be marched in four ways:—

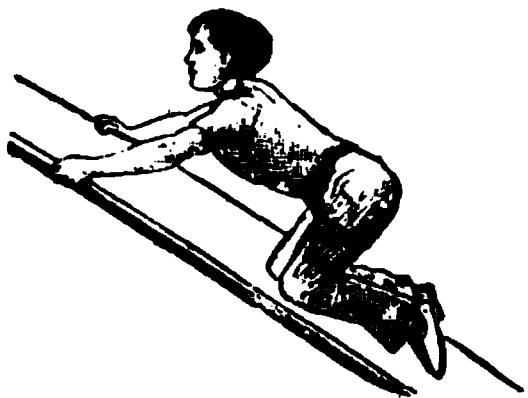


Fig. 62.—MARCHING THE PLANK ON HANDS AND KNEES.

- 1.—With hands and knees;
- 2.—With hands and feet;
- 3.—With legs outside;
- 4.—With body suspended full-length, and progress by hands only.

Hands and Knees.—Kneel on the plank, with feet extended behind, so that only toes and knees touch the plank; grasp with the hands level, on each side of the plank, as far as reach will permit. Then:—

- (a) Bring the knees alternately up to the hands: extend the reach with the arms again, and repeat.
- (b) Bring both knees simultaneously up to the hands, and then take new reach with the latter (Fig. 62).

With Hands and Feet.—Grasp the plank with the hands as before; place the feet upon it, and extend the arms to full reach. Then:—

(a) Advance one foot, and bring the other level with it, and so on.

(b) Advance the hands alternately and bring the corresponding foot forward; then extend the other hand to the level of the leader, and bring the rearmost foot level with the other.

(c) Advance hands and feet alternately, but bring the rearmost hand and corresponding foot a corresponding distance in advance of the respective leader, and so walk the plank on all-fours (Fig. 63).

The plank may be descended after any of these exercises, either by reversing the action, or by simply sitting astride, holding by the hands, and sliding to the bottom. In sliding care should be taken not to slide too rapidly, lest the friction of the plank burn the hands. The descent may also be made by sliding astride, but marching the hands alternately downwards, each taking in turn a new grasp below the other.

These exercises, it must once more be enjoined on the learner, should be repeated right and left.

Astride of the Plank.—Sit astride, and grasp with the hands; take full reach forward, grasp firmly, and draw the body up to the hands. Then take a new reach, and repeat.

With Body Suspended.—This requires more strength of arm and of grasp than the preceding exercises on the plank.

Lie full length on the plank, and grasp each edge full reach. Draw the body up to the hands, repeat the extension, reaching out only one hand at a time, and so progress (Fig. 64).

These two exercises may be practised on a common ladder, inclined against a wall, either by sitting astride of it, or by laying the body full length against it, according to the exercise.



FIG 63—WALKING THE PLANK ON ALL-FOURS.

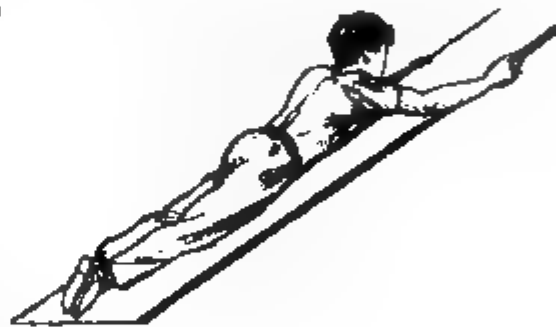


FIG 64—MARCHING THE PLANK: BODY STRETCHED AT FULL LENGTH.

THE GIANT-STRIDE, OR HURDY-GURDY.

The apparatus consists of a stout spar or mast some eighteen feet and upwards in length, planted in the ground to the depth of some six feet. The spar should be strengthened or "shored up" underground by beams slanting from it, buttress-like, into the sub-soil; but these buttresses are best buried completely underground, the spar springing clear from above the ground, with no buttress visible.

The top of the mast is shod with iron, and round it revolves an iron cap in a socket, to which are attached four hooks, and to each hook a stout rope, reaching to within a foot of the ground. For the upper portion of the ropes, within eighteen inches of the hooks, chains may with advantage be substituted, as being less liable to fray. The last three feet of the ropes should be knotted every four or five inches, in order to strengthen the grasp of the hands. The exercise consists of two sorts, one the ordinary "hurdy-gurdy," and the second mainly comprises jumping with the ropes.

Each exercise may be varied by supporting the body either by a grasp of the

hands only upon the ropes, or by sitting upon a cross-stick passed through a loop at the end of the rope at a length sufficient to allow the feet to touch the ground, when the rope is extended some eight feet or more from the base of the mast. A

length of rope, therefore, for the sitting posture must be slightly longer than for the upright progression. But the sitting posture is decidedly the inferior, and to be recognised only as a variety.

In the upright posture, the boys—each rope being occupied—grasp the rope about three feet from the ground, and stand back from the mast till the grasp is raised, by the tension of the rope, to the height of the face; but exact details of these depend more upon the heights of the spar and of the boys.

They then go round the mast with a swinging run, the centrifugal force keeping the ropes at full stretch and the bodies continually off the ground to a much greater extent than in the stride of an ordinary run.

Fig. 65.—THE STRIDE.

The mode of progress in the upright posture may be either in alternate strides (Fig. 65), striking the ground with each foot in turn, and timing the step so as to touch the ground at even distances; or the progress may be by the double swing of both legs simultaneously (Fig. 66), the feet being kept together as they strike the ground, and both legs swinging round as one piece between the strides, while the body is for the time off the ground by the support of the rope and the centrifugal force.

In jumping with the ropes (Fig. 67), a string should be held

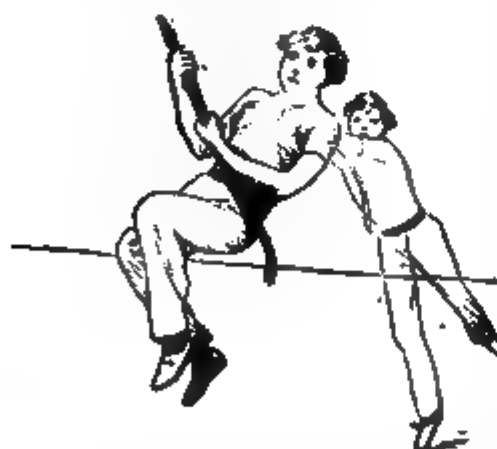


Fig. 67.—GIANT-STRIDE—JUMPING WITH THE ROPES.

up at some point of the compass, the other jump, if at all, being the opposite side of the circle, in continuation of the diameter. But the height cleared will be less, when two obstacles are jumped at either side if taken in the ordinary run round, than if there is only one jump, for the ground cleared in descent from the jump will bring the body on alighting too near to the next jump to allow of a sufficient run to it. When jumping height, the double swing is useless, and even the "stride" should be so far modified as to admit of the feet being



Fig. 68.—GIANT-STRIDE—THE DOUBLE SWING.

brought nearer together at the last final spring.

The arms should pull the body up at the same moment the foot springs. The last foot to leave the ground should be that nearest to the spar, the inside one in going round the circle, and from it the main spring should come. It also should

be the first to alight, the outside foot following and passing it on reaching the ground, to preserve the balance.

The sitting posture hardly admits of or deserves much notice. It consists simply of short quick paddles with the feet to obtain impetus, varied by springing both feet from the ground when once in motion, the body being suffered to swing round by its own impetus. The body should face the mast when sitting.

LEAPING WITH THE ROPE.

This is very much akin to the "giant stride." It brings many of the same muscles into play, but the legs are used only for the spring of the jump itself.

The value of this exercise is to strengthen back, loins, and shoulders, as well as to impart activity to the lower limbs. The rope is suspended from a beam as a simpler resource, and to economise apparatus one of the ropes of a pair of movable parallel rings can be utilised for this purpose. Underneath it should be placed a pair of light, movable posts and a cross-bar, such as has been described on a previous page, for practice of the ordinary running or the pole high jump. In order to facilitate the eye in judging the distance for the take off of the spring, it is a good practice to hang a piece of cloth over the bar to make it more visible.

Fig. 68.—LEAPING WITH THE ROPE (FIRST POSITION).

The exercise is practised thus:—Grasp the rope, one hand above the other, arms at full stretch, and the

body facing the leaping bar (Fig. 68). Then spring, with a slight backward impetus, so as to give time for the feet to be raised before they swing to the fore. Let the body make the letter V at the hips; back rigid, legs extended, rigid, and upwards, and arms bent until the elbows hug the body (Fig. 69). Then shoot out the legs, throw back head and shoulders till the body lies as near as possible horizontal (Fig. 70); the elbows still close to the ribs, but the fore-arms now perpendicular to the body. In this position the body will swing over the bar, and as it passes clear, release

Fig. 71.—LEAPING WITH THE ROPE—DROPPING TO THE GROUND.

arms and loins, lower the legs, raise head and shoulders, and so descend (Fig. 71).

To jump width with the rope, hold it the height of the hips above the ground, and with one hand only at first; step back till the rope is taut; let the foot which corresponds to the hand that holds the rope be in front of the other (Fig. 72).



Fig. 69.—LEAPING WITH THE ROPE (SECOND POSITION).

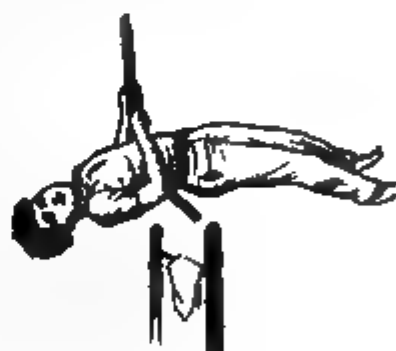


Fig. 70.—LEAPING WITH THE ROPE—CLEARING THE BAR.

Fig. 72.—WIDE JUMP WITH THE ROPE.

Then spring backwards and upwards; and the instant the spring checks, and the recoil begins, grasp with the free hand just above the one already holding, and swing forward, keeping legs rigid and forward, feet close together, and higher than the hips. As the oscillation reaches its full extent, stop the feet, incline the head and shoulders forward, let go the rope, and alight on the feet.

By making many oscillations before alighting, the one swing becomes the simple swing, the body depending on the arms only. The exercise is a good one for lads, especially for in-doors; and a rope, or rope-ladder, with wooden cross-bars, hung securely from a hook in the ceiling, gives ample scope for exercise, and strengthens the arms and back. The rope may be knotted to make the grasp easier. A pair of ropes hung like this can be fitted with rings at the ends, and can also have loops to hold cross-bars of wood, which will transform it into a ready-made trapeze. One of the ropes being coiled, the other will do for climbing or leaping. The cross-bars being adjusted, they serve for climbing purposes.

DUMB BELLS.

In a gymnasium pupils are put through various marches and drill exercises with dumb bells, to teach them carriage of figure, as well as to develop the muscles of the arms and chest. A pair of bells in the bedroom, used for three or four minutes after the morning bath or before bedtime, will help to bring out the muscles wonderfully. Without going into all the minutiae of dumb bell exercise, we may specify a few motions, each of which may be repeated daily six or fifty times apiece, according to the weight of the bells or the power of the pupil. The movements should be done slowly and not in a series of jerks.



Fig. 73.

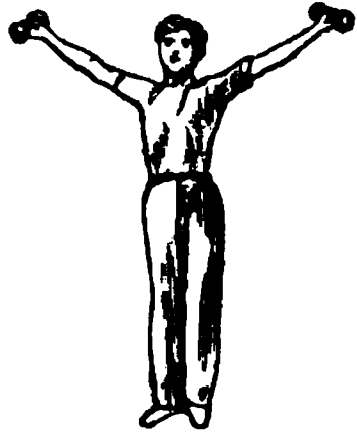


Fig. 74.

1. Hold the bells suspended by the arms at full length (Fig. 73); raise the arms vertically; lower in like manner.

2. Raise the arms horizontally and rigidly till they meet over the head, and lower in like manner (Fig. 74).

3. Raise the fists to the armpits, and lower again (Fig. 75).

4. Raise the bells to the breast, elbows to the sides, straighten the arms horizontally in front of the body and parallel to each other. Swing the arms back in the same horizontal plane, until they make with the body the figure of a cross, and then lower (Fig. 76).

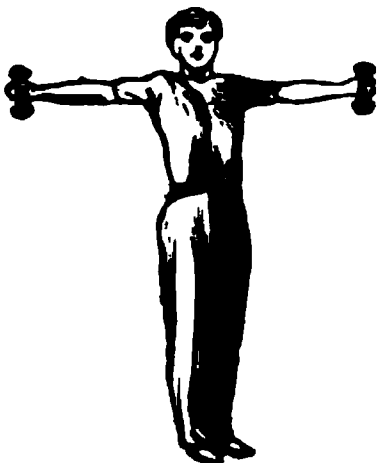


Fig. 76.

5. Place the bells a pace in front on the ground; bend from the hips, keeping the legs perfectly rigid; grasp the bells, and raise them with rigid arms overhead (Fig. 77).

These and other motions combining the same, which may suggest themselves to the pupil, will help to develop the extensor muscles of the arm, for the performance of the various exercises already treated of.

INDIAN CLUBS also afford splendid exercises for developing the muscles of the wrists, arms, and chest; and with these, as with dumb bells, the learner should be careful not to use too heavy weights. Owing to the somewhat intricate nature of the movements, half an hour's practical illustration from a friend will teach him how to use the clubs better than any printed description.

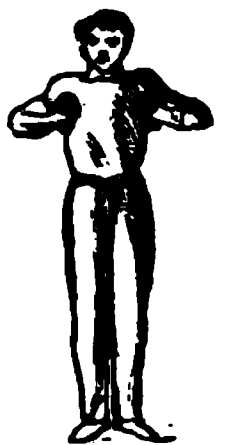


Fig. 75.



Fig. 77.

ROWING.

IN dealing with this subject, we will first treat of the boats and their fittings. As a rule all boats used in racing are built and fitted as outriggers—from the twelve-oars, eight-oars, four-oars, pair-oars, to the sculling boats. The term “outrigger” is understood to mean the iron framework fixed to the boat’s side to support the rowlocks, and is generally applied to any boat fitted with this contrivance (Fig. 1). Another name for them, which is but seldom used now, is that of the “Clasper boat,” from the builder, Henry Clasper, of Newcastle-on-Tyne, who is supposed to have invented this simple but most useful addition to our old-fashioned boats. The sculling boat is composed of two portions: the body or boat proper, and the projecting irons or outriggers to support the rowlocks, which necessarily are placed one on each side, exactly opposite one another. The body is generally built of cedar-wood, in lengths, with ribs or “timbers” of ash, edible chestnut, or sometimes beech, fixed to the inwale, at the upper part (the inwale is a long strip of deal running lengthwise down the inside of the upper edge of the boat), and below, into the inner keel or kelson. Upon the inner keel is fastened a long piece of wood, generally fir, which rises in the centre, under the thwarts or seats, which are fastened to it, to their level, and tapers off fore and aft; the object of this false kelson or backbone being to impart strength to the floor of the boat and to assist in carrying the thwart. The inner keel, kelson, and inwale are first laid down, bottom upwards, on the frame upon which these boats are usually built, and, when built on moulds, the moulds next. The skin is then laid on to the inner keel, inwale, and moulds by the application of hot water, and fastened to the inner keel and inwale; this having been done, the boat in her then condition is turned over, right way uppermost, and firmly fixed on the stocks or frame; the timbers are then put in, and the moulds removed as their places are thus supplied.

Some builders, however, cut out the timbers by rule, and, using no moulds, fasten the skin at once on to them, before turning the boat over. The stem and stern are made of solid pieces of wood, which is sometimes mahogany, cedar, fir, or arbeal, at the option of the builder, and the skin worked up to them; the stem is usually protected by a brass clamp, and the nails used are all made of copper. In addition to the ordinary kind of timbers, larger or “outrigged timbers” are inserted where the iron outriggers will be fixed, and to them the latter are fastened. The interior of the boat is divided into three portions by bulkheads, upon which are fastened the wooden decks, at whose upper corners are small holes for allowing the water to run out, when leaky, by turning the boat topsy-turvy. The washboard rests upon the forward deck, and prevents rough and broken water from coming in. The breakwater runs round the sides of the boat to the coxswain’s thwart, and

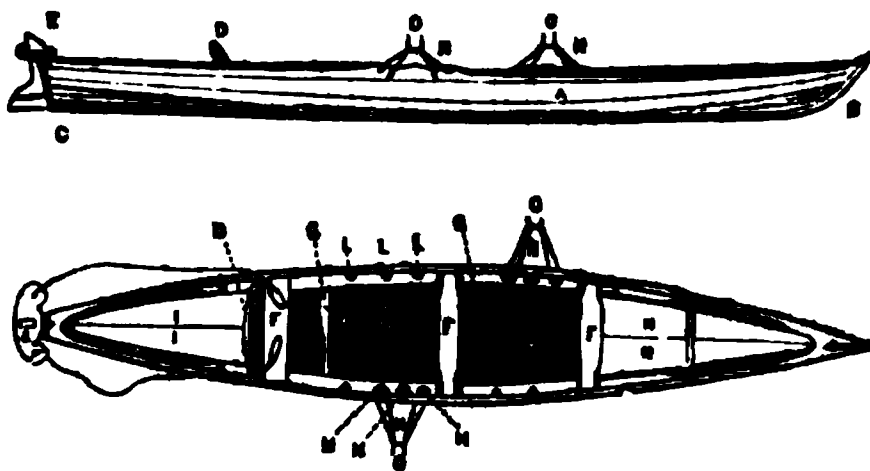


Fig. 1.—SIDE VIEW AND PLAN OF PAIR-OAR OUTRIGGER.

A, Skin; B, Stem; C, Stern; D, Backboard; E, Yoke; F, Thwarts; G, Stretchers; H, Fore Sheets; I, After Sheets; K, Bottom Boards or Burdens; L, Timbers; M, Outrigged Timbers; N, Outriggers; O, Thowls.

crossing the boat abaft his thwart, so ends. The remainder of the boat is covered over with what is technically known as the "canvas," but the covering is made of linen, well varnished, stretched, and nailed to the inwale. It is supported by a long strip of wood running longitudinally down the centre, and called the rising piece, and by cross-beams, which run transversely from the rising piece to the inwale. The canvas is nailed on the outside through the skin to the inwale, and its edge is hidden by a thin beading which runs fore and aft. The skin meets in the centre of the boat at the joints, and is fastened into the inner keel; and there being no outer or visible keel, the bottom is round. The lengths of which the skin is composed are joined by "scarves," put in opposite one another. There are usually four scarves, two on each side, and the boat is thus divided into three lengths of skin, one long and two short; but this rule is not universal. The centre portion of sculling boats is called the "box," and of oar boats the "body."

It is almost needless to observe that all these boats are well varnished outside and in. The stretcher against which the rower's feet are placed is a strong piece of fir fitted into a rack with brass thumbscrews, and this shifts according to the length of the rower's leg; a leather strap for the toes is fastened to it by a small staple. In some boats there are bottom boards or burdens, and in others there are not. If you go to twenty different boat-builders, each will have a different way of putting the work together and of fitting out his boats; it is therefore of no benefit to enter into a lengthy description of all the small technicalities of their business, as it would not answer our present purpose.

The iron outriggers now in use are made of four round stays; not so long ago they were of square iron, and the two lower or middle stays were then crossed. The two upper stays are the shortest, and, with the rowlock-plate, are in one piece; the thowls, which are generally made of beech-wood cased with iron, are separate, and, being fitted with shoulders through holes in the rowlock-plate, receive the lower stays, fastened underneath by means of nuts screwed tight and firm. All four stays are fastened (at their lower extremities) through the outriggered timbers by means of nuts and bolts. When required, cross-stays are also placed inside the boat. The thowls are known by the names of "thowl" for the fore one, and the "stopper" for the after one; across their tops there is generally fixed a piece of twisted string, to keep the oar or scull from unshipping or jumping out of the rowlock.

The sculls and oars are made of white deal, and consist of three parts or divisions, known as the handle, loom, and blade. The handle and loom occupy the length from the rowlock to the middle of the boat, where they should (for river rowing) overlap one another from four to six inches for the style of sculling known as the "overhand," in which one hand passes over the other; but to avoid this the rowlocks are sometimes constructed far enough apart to allow a sufficient length of loom without such overlapping, so that the length of the outrigger irons and half the breadth of the boat, when added together, give the length of the inboard part of the scull, which may be generally taken as something over two feet; but for the overhanded arrangement the boat should not be less than twenty inches wide, and the outrigger must project at least fourteen inches beyond the side of the boat. The handles of sculls or oars are made round for the width of the hand, but the makers are careful not to polish or make them too smooth, usually leaving them just as finished by the rasp.

From the handle to just outside the rowlock most sculls are made square, with an oblong leather "button" nailed fast to the upper side, which corresponds with the back part of the blade, so as just to bear or butt against the inside of the thowl, and keep the scull or oar from sliding out. The "Clasper oar and scull" is different, as it is quite round and covered with leather, with a very peculiarly

shaped "button" encircling three-fourths of the oar at this part, and projecting nearly an inch. Outboard the scull or oar is round at the back for some distance, and square in front; then it gradually becomes oval in section, tapering till it reaches the blade, which gradually spreads out till it forms a breadth of thin wood some four inches wide, or in some cases even more. This blade is curved, the centre being nearly two inches deeper in the hollow than at either end, and is hollowed out something like a spoon in shape, with a web or strengthening piece running from the loom half down the middle, very much the same as the raised rib in a spade; the back of the blade is a little rounded, and the end is usually guarded and finished with a strap formed by a narrow strip of copper carefully nailed on so as to prevent the wood splitting. The oar or scull should be nearly balanced at the nut or button, but in all cases must fall out rather inboard. In racing boats the sculls should never be less than ten feet or more than ten feet four inches long.

The rower in the modern outrigger sits nearly in the middle of the boat, that is to say, about on that part which is one-third of the length of the thwart from the side opposite to his rowlock, where his mat or pad is firmly tied, and upon the front edge of this he sits, bending his knees, separating them about a foot, and placing his feet, with his heels close together, firmly against the stretcher, exactly in front of the middle of his body. Thus he sits quite square to his work, and will then be sure to swing backwards and forwards exactly in a line with the boat's keel, or parallel with it. If his feet are nearer the side of the boat than they ought to be he will swing towards the middle, or "row into the boat;" and if they are too near the middle line he will "row out of it," both being bad faults, and making the boat rock and roll very considerably; the stretcher should be adjusted to such a convenient length that in the stroke the oar should just clear the knees, and the strap should be buckled tightly over the inside foot, which is the one upon which most strain falls in feathering the oars. The thwart on which the rower is seated should be of such height that the rower may have a good command over his oars, but sufficiently low to let him get well over his knees; the lower the seat the more likely is the rower to depress or drag his boat's bow under water, and the higher in reason that he sits—so that his hands clear his knees—the lighter and smarter will be the stroke, and the less will be the boat's dip when she is hanging on the rower's hands (Fig. 2).



Fig. 2.-SCULLING.

The action of rowing is made up of two portions, and therefore twofold, i.e., the stroke and the feather. The stroke is the putting of the oar through the water, with the blade, to which the water offers a resistance in its passage at right angles to the fluid traversed.

Feathering (Fig. 3) is, strictly speaking, the turning of the oar at the conclusion of the stroke by turning the wrists, and thereby bringing the blade into a plane with the surface of the water; but the term is also commonly used as including the carrying back of the oar in the same position or plane and recommencing another stroke, as the oar is then said to be on the feather. This great accomplishment of rowers can be acquired or caught only by the learner carefully watching and imitating masters of the art, and this is succeeded instantly by the oar being restored to its former state, in doing which the wrist is straightened, and both

hand and elbow thrust rapidly forward at the same time, to which is added a forward action of the shoulders, so as to carry away the loom from the body at once, and then when the arm becomes straight the body follows as rapidly as is necessary.



Fig. 3.—FEATHERING—FIRST (A) AND SECOND (B) POSITIONS.

The head is kept well up, and the eyes looking full at the back of the man in front; the chest full, and well to the front; the back straight, the shoulders moving easily forward, and the hands reaching well over the toes.

All these evolutions cannot be carried out in the first few lessons, the pupil gradually learning the first rules of rowing, i.e., the power of swinging his body properly, and of preventing the catching of "crabs" (Fig. 4), which usually result from the water being allowed to catch the

oars when the boat is moving rapidly through the water, or, technically speaking, has considerable "way" on her, and turning the blade flat, so that the rower cannot bring it out, and by the impetus of the boat is forced backwards over his thwart.

As a rule the pair-oared outrigger is much the same as the sculling boat, but longer, wider, and sometimes with a keel. They are built much stronger and heavier than the ordinary sculling boat, from the strain not being even on the two sides, owing to the alternate fixing of the outriggers on each gunwale (Fig. 1). Unless a boat is reasonably stiff in her length she will not row well, because at the moment she is being impelled by the oar she trembles and twists, changing for that instant her proper form, as well as taking a slightly serpentine course.

The racing pair-oars are usually about thirty-four to thirty-six feet long, and from seventeen to nineteen inches wide; but they are always built in proportions suited to the weight of the men they have to carry. These boats are usually covered in at the bows and stern with canvas or duck, in place of

mahogany or cedar, as in former days, in order to save the weight of the wood, and their skin is usually of yellow pine, though in some cases it is made of mahogany or cedar. The greater length in comparison with the sculling boat is placed in the middle, so as to give room for two men instead of one; and when steering is required, more room is given for the boy to sit when handling the yoke lines (Fig. 5). But this addition is only

Fig. 4.—"CATCHING A CRAB."

Fig. 5.—ROWING PAIR-OAR OUTRIGGER.

allowed in winding rivers, where it is impossible to avoid running on shore without a coxswain. On the Thames such a thing is never seen in a race, but boats do not always follow a straight course, and, as a consequence, lose some distance by overshooting the line to the right or left.

The two rowlocks are known as the after or "stroke rowlock," and "bow rowlock;" the former is generally bolted to the left side, in front of the "stroke" man's thwart, and between the two thwarts on the other side is bolted the bow

rowlock; the exception to this is when the stroke-oar cannot row on the stroke side, in which case the rowlocks are reversed, and he is said to row stroke on the bow side. The oars are in form merely enlarged sculls, being somewhat longer, and the square of the loom is gradually rounded off into it for about five or six inches, for the greater convenience of holding it with the inside hand. When all are on board, pair-oars are very little higher out of the water than sculling boats, being about four inches and a half between the water-line and edge of the gunwale. The strakes or skins are put on in breadths or sheets of the same size as the boat from keel to gunwale, and are generally in two lengths, scarfed together about four feet apart on the two sides, so that each side is divided into two unequal portions, one having the greater length of plank forward, the other the greater aft. The skin is of the same thickness or substance as the sculling boat, but the timbers or ribs are considerably stronger, and are carefully framed into the keel, which is now usually strengthened by what we may call a backbone, which is a piece of deal or other light wood, running longitudinally fore and aft along its surface, and shaped so as to rise up to the under surface of the thwarts, which are securely nailed to it.

The four-oared outrigger of the present day is constructed just like the pair-oared, except that it is some eight feet longer. It is generally forty-two feet long, from twenty to twenty-two inches wide over all, and one foot deep amidships, seven inches and a half at the bow, and six and a half at the stern; the distance from the thwart to the thowl of the outrigger is one foot one inch. The midship oars are twelve feet five inches long, and the buttons are fixed on at a distance of three feet five inches from the end of the handle; the bow and stroke oars are twelve feet four inches long, and have the buttons put on three feet four inches from the end of the handle. The space between the coxswain's thwart and the stroke's stretcher is one foot, the breadth of coxswain's thwart being eighteen inches. Formerly these boats were built forty-eight feet in length, and only twenty-one inches in width, even for a heavy crew, but the present proportions are found to be a marked improvement, for when they were so very narrow and long they did not offer sufficient resistance to the burying power of the stroke, and were forced deep into the water while "on the hand," rising again in what is technically termed "the shoot," the consequence being that the boat made a succession of dips, causing a great loss in her speed. For many years the idea prevalent was that the only limit to diminution of breadth and increase of length was the difficulty in making the boat of such stiffness as to stand up under the weight of her crew. These reasons, derived from experience, have been the chief cause of the length and breadth and depth now adopted, the proportions named offering the right amount of resistance to the downpull when the rowers are in full swing. Up to recent times rudders have always been used in four-oared boats, a thwart being fixed for the coxswain, who is usually chosen for his light weight. Now, however, four-oared races are rowed without coxswains, stroke or some other man steering by means of an apparatus coming to his feet as they are on the stretcher, when he is rowing.

The eight-oared outriggers are constructed in exactly the same manner as the pair-oared boat, except that they require more space for extra men. They are much longer, being fifty-six feet in length, two feet two inches wide over all, and one foot one inch deep amidships. The old-fashioned boats were commonly sixty-five feet long, in some cases even seventy feet, and two feet three or four inches wide. The outriggers are placed four on each side, and must be suited to the men who are to row in her, as the position that will suit one will not do for another; the six amidship oars are twelve feet six inches long, the bow and stroke twelve feet five inches in length.

Twelve-oared outriggers have been built, but are not often used. They are simply elongated eight-oars, and need not be further described.

Before purchasing any boats, or taking them over if built to order, they must be carefully tested and examined, to see if they are sufficiently stiff to prevent their getting "screwed," i.e., getting out of shape when rested on either end. A crooked keel, resulting from a strain, is always an annoyance, as it causes the boat to bear more on one hand than the other, and, from requiring constant steering on the side affected, impedes her way. Of course no boats are mathematically correct, as a practised eye will detect some little deviation from an exact correspondence between the two halves of the boat when standing at head or stern, and looking down the centre line.

Since the introduction of the sliding seat, the art of rowing has undergone material changes, but it is open to question whether style has gained by the alteration in the seat. The sliding seat is an American invention, and consists of a seat which is capable of sliding backwards and forwards, through the motion of the oarsman's body. This has the effect of reducing the swing forward to a great extent, as the crew slide forward in a more upright position than was formerly the case.

The three main principles of successful rowing are, first, perfect time, secondly, getting the oar into the water square, i.e., at right angles to it, and thirdly, rowing

the stroke right out and using the legs well. With reference to "time," all that can be said in the way of advice to a beginner is, be determined never to remove your eyes from the shoulders of the man in front of you. Follow his every motion, and if the time is wrong you will not, at all



Fig. 6.—A WELL-COACHED CREW.

events, be to blame. Be careful not to hurry the body forward, under the impression that you may otherwise be late, for this only makes the boat roll, and nothing demoralises a crew more than that. Be sure to bring your hands well up to your body at the end of the stroke, and on no account keep them there longer than you are able. A quick recovery after a stroke and the free use of the legs the moment the oar gets into the water are important agents in the acquisition of that "lift" which is so desirable to obtain in boat-racing. A well-coached crew (Fig. 6) will, when rowing, fairly make their boat seem to jump out of the water at the beginning of each stroke; and the value of all work done in *front of the rowlocks*, i.e., in the first part of the stroke before the blade of the oar comes level with the oarsman's body, is almost beyond estimation. As regards the oar itself, it should be brought straight home to the chest (Fig. 7), the knuckles touching the body about an inch or less below the bottom of the breast-bone, where the ribs branch off, thus every inch of water is made use of. When there, the hands should be dropped straight down, and then be turned over and shot out again along the legs, and the body should follow without the

Fig. 7.—"BRINGING THE OAR HOME."

least pause. If this is not done the oar will be feathered under water, and thus the boat will be buried, water will be thrown on the next oar, and the recovery will be impeded. To effect a quick recovery the back must be perfectly straight, the knees must not have been dropped down too low, and the straps must not be used too much; a light touch is all that is needed. The muscles of the body—in this case those that cross the stomach—must be used, and not the boat itself, of which the strap is a part. The body should be swung evenly forward from the hips, not with a jerk or a plunge, or quicker at one time than another, but freely and easily, as if the hip-joint worked well and not stiffly.

Be careful always to get the oar in *square*; if it goes into the water obliquely the blade will get in much too deeply, and the ship will roll; be sure also that the blade of the oar is well covered by water, but no more. Deep rowing makes the boat roll, and if the oar is not in deep enough an insufficient amount of work is done, and a splash is also caused which inconveniences the other men. In swinging backwards and forwards, be sure to do so straight between the knees. Many otherwise good men, screw across the boat, and thereby not only spoil the appearance of the crew, but make the boat unsteady, and so spoil the pace. Feathering under water is a very common fault in the best of crews, and it consists in commencing the feather before the oar is well out of the water. This is never the case when the stroke is rowed well out, and the hands brought well up to the body before the feather is commenced.

“Holding water” is necessary when the boat is to be suddenly stopped, in which case her crew on both sides reverse the blades of their oars, and, according to the pace at which they have been going, drop them more or less into the water, holding their arms straight, and keeping the inside hand firmly upon the loom, to prevent the water from sinking the blade too far under, and thus causing a “crab.” It is a very difficult manœuvre to execute well, but after a

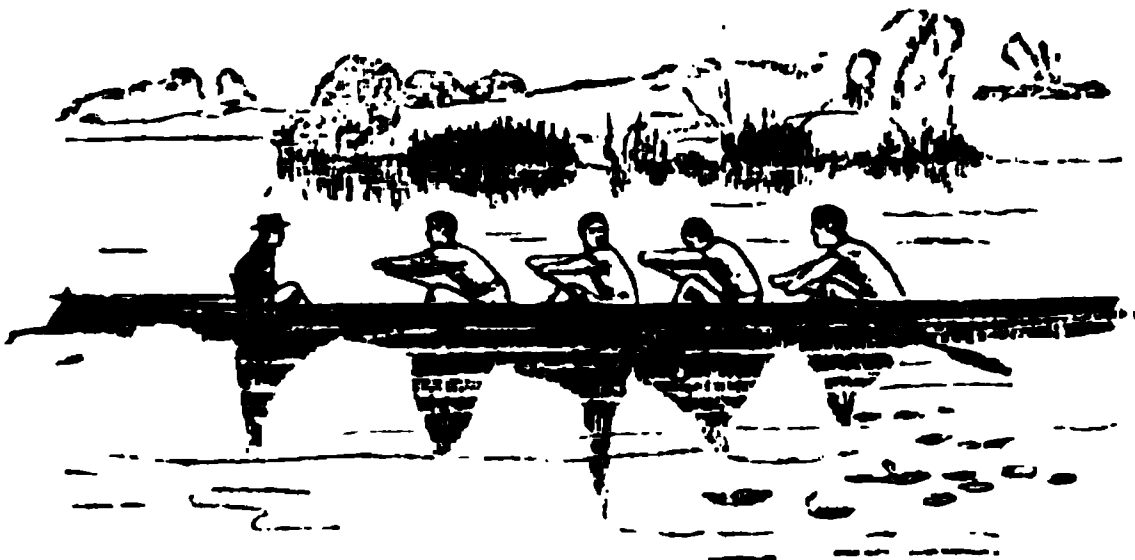


Fig. 8.—A “RAGGED” CREW.

great deal of practice it will be found that by a simple turn of the wrist, so as to twist the handle to or from the body, the blade can be raised or lowered according as it is found necessary to slacken or increase the power exerted to check the boat, *i.e.*, by simply turning the blade with its upper edge downwards towards the nose of the boat the oar sinks, and by depressing the lower or after edge it immediately rises to the surface of the water.

“Backing” is performed in exactly the opposite manner to rowing, *pushing* the blade through the water, and *pulling* it through the air the moment it leaves the water. The blade should be neatly feathered, care being taken not to dig too deep, and to back in *good time* and with the same length of stroke. In rowing and backing a boat round, care should be taken that it is done as gently as possible, for nothing strains or screws an outrigger so much as force applied under these circumstances. A boat will last as long again as she otherwise would if this point is always attended to.

“Paddling” is simply the act of rowing at about half-power, or a milder form of rowing hard, of which the opposite extreme is spurling; the pace is about

twenty to thirty strokes per minute, according to their length, and according to the amount of strength applied. At this pace one can detect every fault, the keeping of time and stroke, if bad, being very evident; paddling is therefore very valuable for the coaching of crews before venturing on races, especially those that are to be contested over long distances.

"Spurting" is performed by all the crew exerting themselves to their utmost powers to propel the boat through the water with the greatest velocity of which she is capable, whatever the distance may be, a few boat lengths or half a mile at a time.

"Easing," or stopping, and starting, being the exact opposites of one another, are performed differently; the former is merely the ceasing to row, all together, at exactly the same moment, and when the coxswain gives the word "Easy all," which he should invariably do at the end of the stroke, all the oars should not be wholly recovered from the feather.

The length of the stroke is that which *all* in the boat can well keep up without the forward reach being so far as to make the drop unsteady, or the backward swing being carried so far as to bear too hard on the oar, and thus cause a depressing or downward pull on the boat. The stroke-oar must be very careful not to *over-reach* his crew, though he should be able to do so if necessary, by which a young crew will be greatly improved, and have their style and powers developed to the fullest extent.

Straps have come greatly into use since the present light racing boats have been the fashion, and were introduced to enable the rower to raise himself after delivering his stroke without bearing too heavily on his oar; and now a regular rower could not put forth his powers of muscle, and get the utmost amount of speed from his egg-shell boat, if he were without straps. Some great authorities say that straps are objectionable, as they cause the body to be doubled forward on the oar; but this is more owing to the lightness of the boat than to the straps themselves.

Coaching is a very important portion of a rower's studies, as upon it depends his proficiency in the art; and novices should always learn from an acknowledged master of the oar, as their form will in the future depend entirely on the capacity of their teacher. Beginners should invariably be taught in tubs, to acquire the proper manner of handling their oars, boats, and yoke lines, and their teacher should accompany them in their boat to correct every error, and tell them how to become perfect in each action and movement. It takes a very, very long time to get a crew to row well together; and in commencing it is a vital point to select healthy men, as during their training they have to undergo some trying work, which will tell severely on any but a thoroughly good strong constitution. Some people say that from the waist down in rowing the whole limbs are idle, but one moment's consideration will show the fallacy of such a statement, for the legs, thighs, and lumbar muscles all have to take their share of the work, and are most essential to the proper performance of the oarsman, good thighs and knees being as requisite as shoulders, chest, and arms. The power seems to be in the arms and back, but this force cannot be exerted unless the pushing power of the thighs and legs against the stretcher tended to prevent the body from slipping off the seat and taking its place on the floor of the boat. The man's frame should in all cases be examined, to see if he has a muscular development such as will enable him to put forth the force that will pull the oar through the water in the orthodox manner; for unless the loins are powerfully developed the finest muscle and bone of the arms and shoulders are utterly worthless, and a race may be lost from mere want of attention in selecting a properly proportioned and developed crew. The best way of selecting men is to take them out in an old-fashioned boat or skiff, and before the start everything should be set in

proper order, or the mat, stretcher, oar, or other things may be found wrong, and in the end cause unexpected errors in the pupil's work. The instructor sees that his pupil is in a proper position—i.e., that he is quite square and upright on his seat, his feet pressed firmly against the stretcher, with heels together and toes well apart. The outer hand should be close to the end of the oar, the inner hand about three or four inches from the other, his arms being straight, his shoulders square, chest well out, the head well up, and the knees apart. He must reach out and try a stroke, which is to be closely watched by the teacher, and every movement explained and pointed out to him, and shown at the same time by the teacher himself rowing a stroke or two. The body should bring its weight to bear on the oar steadily, and both the entry and finish be clean and neat, command being kept over the oar from beginning to end of the stroke, for with a novice the oar will, in naval parlance, "take charge," and be the master of the learner.

These last lessons must not be too long in their continuance, but be frequently repeated for some weeks, till the learner has perfectly mastered the rudiments of the craft. Much good is derived by the pupil occasionally changing places with the instructor, and carefully watching every movement as to handling the oars, and after feeling that he has overcome many little points he could not quite see before, he should again change places, and practise what he previously did not see the way to accomplish.

When he is considered to be a proficient in pulling his oar through the water, he may have some practice with a good oarsman rowing stroke, by which he, in taking the bow oar, can learn to keep time, and see how the oar should be manipulated to get the utmost power out of it in the act of propelling the boat; but it is by no means the case that the best oarsman makes the best "stroke," for many men who are excellent when in a boat, behind others are so wanting in judgment and "time," that the whole crew are thrown out directly they take the after oar. The man entrusted with the all-important post of stroke should under every circumstance be a good oarsman, and possessed of that amount of pluck that will enable him to "spurt" when the critical moment comes, and by sheer force of example put new life into his exhausted crew.

Presence of mind is another much-needed requisite with a good stroke, as it enables him to keep the time of his stroke throughout the race, and avoid any hurry when his antagonists may be pressing him unpleasantly. Many a race has been lost for want of presence of mind; and it seems hard to reproach a man for the absence of a quality that he does not possess.

Every one of the crew should copy the manner, style, and peculiarities of the stroke. During the whole of this practice the teacher must be careful to give a reason for every little thing that he shows his pupil; let him be forbearing and not lose his temper, for on this very much will depend, the end being that the learner will leave off a proficient in all the little niceties and finished actions which make an accomplished oarsman. A coach will soon find after some practice those of his pupils who give the greatest promise of being good oarsmen, and, when the time comes, preference can be given to them if they can be placed in such crews as are to race.

The duty of the coxswain is one of the most important in boat-racing, but at the same time a very simple one, as it often makes a very great difference in the distance to be rowed over whether the men are taken in-shore to save them, or out in the current, when rowing against stream, to tire them, or kept well out in the current in place of along the bank when coming down with the stream. The coxswain should direct each man what to do and when to put forth his strength, give the order when to start, stop, or ease; the yoke lines should be kept "taut," so that the rudder cannot move with the pressure of the water on either side, and by a

careful adhesion to this rule the boat can be moved in any direction by the slightest touch of the lines, as a sharp pull when the boat is going at a rapid rate will send her out of her course far more than is necessary.

In turning sharp curves the outside oars must be pulled hardest, the inside being just kept moving, and in some cases even backing water. The coxswain should call out to his crew, saying, "Pull, bow side," or "Pull, stroke side;" and again it may be necessary for him to say, "Ease, stroke" or "bow side." But of course these tactics do not refer to the management of a boat during a race. The rudder should be used as *sparingly* as possible in turning, as a sudden use of it will impede the boat's way too much and tire the men, when, by using the oars, all is done that is necessary. Coxswains are chosen for their light weight, and, if possible, they should be men endowed with great presence of mind and decision of action to get the boat out of any position of danger or difficulty in which she may be placed; but this seeking after light-weights should not be carried too far, as a stone or two of greater weight, combined with the requisite knowledge and a cool head, will do more to win a race than having a feather-weight, empty-headed coxswain, who does not think of what he is doing. Races are sometimes thrown away when hanging in the balance by a lamentable want of judgment on the coxswain's part, by his steering suddenly in the wrong direction, or failing to call on his crew at the right moment to make a spurt, which in all probability would have made them win by half a length or so. It requires considerable nerve and determination to keep a boat going on her course when pressed close by an opponent, as, if the coxswain were to give way the loss of the race might be the consequence.

In coming up to a point that has to be rounded the boat must go round in a steady curve, in place of being jerked round at almost an angle. In a heavy wind abeam the coxswain's best judgment is called into action, as then the boat is fast making lee-way, and it will be found very necessary to keep her head pointed somewhat to windward of her true course.

The coxswain may very much influence the fate of a race by judiciously *washing* his adversary, that is, giving him the full benefit of the wash from the wave of displacement which usually follows a boat's quarters, for if sent on the bow of a boat it very materially affects the result of the contest.

TRAINING.

If the crew selected to row is a large one, it should be a rule, if possible, to keep them together day and night; and, if this cannot be done, they should certainly have their meals and runs together, and should never, especially at night, be free from "surveillance." Where practicable, lodgings should be taken near the river, but on high open ground, if possible, as low ground on a river bank is very objectionable. If in the summer, the training should take place in the mornings and evenings; but some object to this plan, and say the rule, subject to variations in the time of year and in the weather, should be for all to rise at seven o'clock, and either jump into the river and come out again immediately, or sponge themselves with cold water and be rubbed dry with a coarse towel, getting dressed by half-past seven. They should then take a smart walk, and come into breakfast ready to enjoy it, but free from fatigue. Many trainers, however, prefer to defer the "matutinal tub" until after the men have had their row. This is a matter of opinion, and hardly necessary unless very severe training is being undergone by the crew.

In our opinion the golden rule for all men in training to follow is to keep the body in a state of temperance and sobriety, and to give up smoking and the frequenting of ill-ventilated rooms; above all, the man trained should enter heart and soul into the task before him.

If a man is tall, fleshy, of full habit, powerful frame, and of great bulk, he must be ground down to get rid of his fat; but it is a mistake to reduce a man simply because he is heavy.

As regards diet in training much has been said and written, but we believe that the exercise of common sense has more to do with good condition than the slavish adherence to the rules of any writer. For instance, what medical man in possession of his senses would admit that every member of a crew had an identical constitution? therefore, how is it possible for all to benefit from a similar course of training? Delicate men require a certain amount of coddling; gross men must have plenty of work to get them fit. A mild dose or two of physic in the early stages is beneficial, as it removes internal fat, but after that, as a rule, it is better to keep the bowels open and the blood cool by the free use of green food, such as watercress, lettuces, and cabbage at dinner. As to the diet for ordinary training, which is all we can touch upon here, we strongly advocate chops or steaks, not necessarily underdone, for breakfast, which may be augmented by boiled eggs and marinade, lettuces, and watercress. Tea is better than coffee, and the less sugar taken the better. Enough food and fluid should be taken, but overcrowding the stomach is most undesirable.

If the crew mean practising in the early afternoon and dining afterwards, a very light lunch is often given about noon; and for dinner good solid joints of beef or mutton, with a few potatoes and plenty of greens, is the best staple fare. Light puddings and stewed fruit may be taken, but no cheese, and some good sound beer is the best drink. Chicken and fish may also be given, and in short, any *nourishing* and easily digestible food can do but little harm. Toast is better than bread upon all occasions, and the less fluid drunk the better. The first few days' training will probably produce an intolerable thirst, but this will soon wear off, and until it does so the mouth can be rinsed out with water, which is a great relief. An orange or a few French plums and biscuits after dinner can do no harm, but a good walk is necessary to assist digestion an hour or so after the principal meal has been partaken of. Supper may be taken about 8.30, and should consist of a biscuit and a *little* meat if the man requires it, washed down by either beer or tea. The hour for retiring should be from 10.30 to 11, not earlier or later, as too much bed is as bad as too little rest. We believe these few suggestions, which can be modified according to circumstances, are all that are necessary for an ordinary preparation, but of course extraordinary events will be met by extraordinary measures, and the services of an experienced trainer most probably engaged.

Many men suffer from diarrhoea or constipation during training. In the former case a cessation from hard work, in the sun particularly, is often imperative, and if the ailment is obstinate medical advice should be obtained. A mild dose of physic, and an extra allowance of vegetables, will usually cure the latter trouble, though it sometimes leads to troublesome boils which require a doctor's aid. Blisters on the hands, too, are often very troublesome, and cause anxiety to pupil and coach alike. The best thing is not to prick them until they are thoroughly developed, and then only enough to let the water out, for the skin should not be removed or a bad sore will be the result. The hands, if uncut or unwounded by blisters, can be hardened by rubbing with powdered resin, or by being frequently bathed in cold water, in which some alum or Goulard water has been mixed.

CANOEING.

THE cruises of Mr. Mac Gregor in the *Rob Roy* canoe in various parts of the world, and the subsequent publication of the log of his voyage, awakened an interest in what had been hitherto looked upon by rowing men as a "duffer's" craft. Paddling a canoe is an art which may be acquired in as many minutes as it takes days to learn even passable oarsmanship, and for this reason—"loafers" who had neither energy nor patience to submit to "coaching" for oarsmanship, but who none the less liked to dabble in the water, gladly took refuge in canoes, as being more easily managed than rowing-boats. There were no "crabs" to catch when handling a paddle, and no fellow-oarsman to demand that time and swing should be preserved; and this, coupled with the facility for rambling up narrow rivers and ditches, in which there was no room for oars or sculls to be worked, but which afforded scope for the use of a paddle, all tended to find votaries for canoeing. The exercise cannot compare to that of oarsmanship, and is even injurious to

growing frames if indulged in to any excess, tending to cramp the chest, and to employ the arms and shoulders only, while the legs and loins are passive. No growing boy should indulge, except for occasional pastime, in any exercise which does not bring into play his legs and loins. However, when canoeing became used as a means to an end, and not as an end of itself, as a medium for enterprise and exploration in tortuous and shallow waters and strange countries which did not admit of the use of oars, it obtained



Fig. 1.—CANOEING.

a certain amount of toleration among aquatic men which could not have been accorded it had it been sought as a mere exercise. There is many a small river which a boy may navigate in a canoe, but in which he would have no room to wield oars or sculls; and even in a lake or pond at home he will not do harm if he is capable of handling a canoe, though he will do better still if in such open water he takes advantage of the room afforded him to work a rowing-boat.

Canoeing has also developed into a miniature style of yachting, and cruising canoes are often found, which combine good sailing powers with facilities for paddling, though, of course, they are not so light and handy for the latter work as canoes built solely for paddling purposes. The two most common types of paddling canoes are what were originally modelled on the lines of *Rob Roy* and *Ring-Leader*, and as such were classified under these two heads. There is another well-known build called the *Nautilus*, the chief rôle of which is sailing; and, moreover, the Clyde canoes are of a somewhat different pattern. Most of the modern-built sailing canoes combine paddling with sailing fittings, except what are known as "Canadian" canoes. These latter are not decked or canvassed at the ends like British canoes, but are open at both ends. In Canada, for colonial use, they are usually built of birch-bark, but those built in the colony for exportation to England are usually constructed of bass-wood, which is light, but much stronger than bark; they are very shallow, and will float almost in a marsh. They can be easily carried on the back, weighing 50 lbs. on the average, and are useful for conveyance to fishing quarters in which a boat is not kept.

HOW TO USE THE PADDLE.

It is almost needless to say that a canoe has no rowlocks. The water is the fulcrum; both hands grasp the paddle, the lower hand is the "weight," and the upper hand the "power," to a great extent; but both hands shift their posture during the stroke, so that the lever partakes as much of the third order as of the second. An English canoe paddle has a blade at both ends of the staff; a Canadian has one blade only. The Canadian paddle is used on one side only of the vessel, and as the stroke tends to turn the bows away from the side on which the stroke is made, the course of the canoe is corrected by turning the blade almost parallel to the keel of the boat at the end of the stroke—one edge of the blade uppermost—and with a lateral pressure outwards steering the bows back to the point whence they deviated at the beginning of the stroke. Some propulsion, however, is lost by thus steering against the previous propulsion of the paddle; but the time and exertion of lifting the paddle over to the opposite side for a corresponding stroke are thereby saved. The Canadian canoeist usually kneels to paddle. It should have been mentioned that the canoeist sits facing the direction in which he progresses. In the English canoe he has a back-board to lean against, reaching as high as his shoulder-blades (Fig. 1). His legs are extended flat along the bottom of the canoe, and his feet supported against a stretcher or board at the end, to prevent his slipping forward when he presses his paddle against the water.

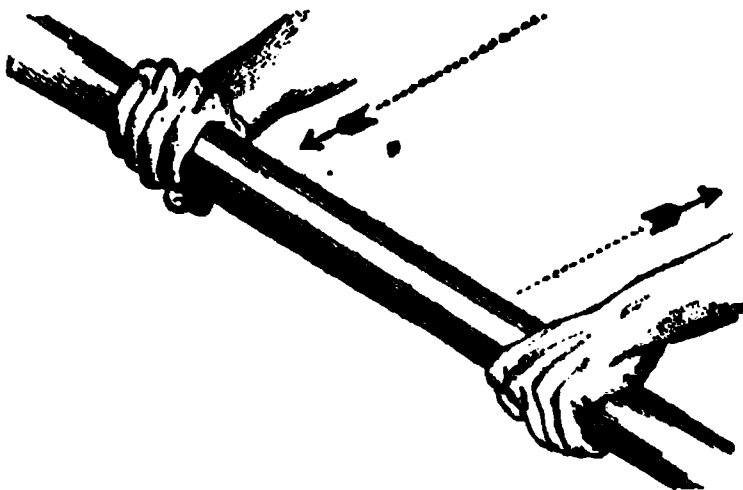


Fig. 2.—GRASPING THE CANOE PADDLE.

The English canoe is, as said above, propelled by a double-bladed paddle. The hands grasp the paddle about two feet apart, at equal distances from the blades, and the stroke is made alternately on either side. The lower hand pulls the paddle towards the sitter, while the upper arm is extended, and pushes the upper end of the staff in the opposite direction; the blade which is in the water is thus forced backwards in the direction of the

stern of the boat, and the boat is propelled. When the stroke is expended the upper hand is lowered and the corresponding blade takes up the stroke on the opposite side, the action of the two hands being now reversed, and so on (Fig. 2).

The closer the stroke can be made to the gunwale of the canoe, the less tortuous will be the course of the vessel; but, of course, she steers to port and starboard (left and right) alternately, according to which side the paddle is working. To turn the canoe, back water on one side, and paddle forward on the other, with alternate strokes; while doing this leverage is gained by placing the blade as far out as it can reach from the side of the canoe, whereas in straight progression the object is to keep the blade close to the side.

The upper part of the body should lean against the upper hand during the stroke. This counterpoises the necessary bias of the body in the direction of the lower hand, and keeps the canoe upon an even keel. The feet should be pressed firmly against the stretcher, and the knees kept stiff, so as to force the loins and lower part of the back against the back-board, and prevent it from slipping, an accident which it is of course highly desirable to avoid.

A tarpaulin should be thrown over the legs, from the feet to the waist, just fitting the open part of the canoe, or "well," in which the sitter sits; this saves him from the constant drip of the paddles as the blades are alternately

lifted from the water, which would otherwise drench his legs through in a very few minutes.

DOUBLE CANOES.

Double canoes are sometimes built for two sitters, one in front of the other (Fig. 3). The process of propulsion is the same, but they are not so handy as single canoes, are more difficult to turn, and, from their greater length, are applicable only for paddling, and useless for sailing purposes, of which more anon.

BALANCING A CANOE.

Fig. 3.—DOUBLE CANOE.

The centre of gravity in a canoe is lower than in that of a rowing-boat, by reason of the occupant being seated on the "burdens" (or bottom boards), and having no thwart (or seat) to elevate him, as in a boat propelled by oars. For this reason there is less to make her roll; but if she does not do so, there is less to restore her balance than in any rowing-boat. An inrigged rowing-boat (one in which the rowlocks are placed on the gunwale) has far more beam than a canoe, and though she may roll, will not easily capsize, even without oars in her, and if the latter are in the rowlocks and held by the hands they assist to preserve her stability. An outrigger boat (in which the rowlocks are placed upon irons rigged out from the gunwale) generally has her oars or sculls tied in across the loom of the oar, and while these are held firmly in the hands it is next to impossible, with any ordinary usage, to capsize her.

But the canoe has no such lateral support, and the occupant must rely upon his own steadiness of seat and balance of body when he uses his paddle to preserve equilibrium. At first he may be alarmed to feel how easily she rolls either way if he leans over the gunwale, or if the weight of his paddle on one side sways her; but he will soon get accustomed to a sort of instinctive balance, such as a skater acquires, and the chief thing which he should bear in mind is, that he must not roll with her, but endeavour to keep his body upright, and by so doing he will find the canoe promptly right herself under him and return to the dictate of her centre of gravity, which lies in the sitter's own body.

THE APRON.

One precaution should be observed, viz., not to tie the tarpaulin round the body like an apron, if a tarpaulin is used. The ends of the tarpaulin which cover the feet may be secured to the boat, but the upper ends should lie loose. There is thus nothing to fetter the lower limbs should the canoe capsize and the occupant have to swim for it.

BUILD OF CANOES.

Canoes are now commonly constructed to combine both paddling and sailing. If a canoe is designed for paddling as chief duty, and for sailing only as an occasional auxiliary, she will not be expected to carry so much canvas as a canoe required chiefly for sailing, and she may, therefore, be longer in build and narrower in beam, so as to make her lighter and speedier under the paddle.

PADDLING CANOES.

Such a canoe may be about fourteen feet long and ten inches and a half to eleven inches and a half in depth from deck to top of keel, according to the weight she is constructed to carry. Most canoes are built with too much beam abaft and too little forward. This is because the sitter—if he sits *amidships*—throws the greater part of his weight abaft of *midships*; but a canoe will be found to possess more speed both for sailing and paddling if the sitter is placed more forward and the beam regulated accordingly, the greatest beam of the boat being opposite his calves, which should be about six feet from the bows. The “well” of the canoe is the space in which the sitter is placed, and is about thirty-three inches long and twenty-four inches wide, according to the length of leg of the sitter for whom she is built. Usually this well is in the centre of the canoe, and her greatest beam then extends equally along the whole length of the well. Very few canoeists and builders see the point of carrying the beam and the well more forward, but those who will do so will be repaid by increase of speed without any loss of stability, and by improved “weather” qualities in their craft when they come to sail her.

The beam of a fourteen-foot canoe should be about two feet eight inches; a fifteen-foot canoe should be about two feet seven and a half inches in beam. The keel should be slightly “camber” (*i.e.*, rounded or hog-backed) when the boat is laid keel uppermost. The paddle should be about seven feet long, the blades from seven to nine inches wide, according to the size and strength of the canoeist. A good deal of the unpleasant dripping from the paddle, above alluded to, may be avoided by having two thick rings of india-rubber slid on to the shaft of the paddle, and placed only within a few inches of the bottom of either blade. They should adhere by their own elasticity, and not be nailed or screwed, else the nails tend to make the shaft of the paddle split. The rings will not stop the water from falling on the tarpaulin apron, but will stop it from running down the shaft of the paddle into the hands, a valuable saving in cold weather. Paddles are often made jointed in the middle, with brass fittings, so that they can be unfastened at will and used separately.

A canoe of these dimensions should carry but moderate canvas. The sailing fittings of canoes will be alluded to later on (*see pp.* 214, 215).

CRUISING CANOES.

A cruising canoe (*Fig. 4*), such as the “*Nautilus*” type, is designed principally for sailing, but at the same time quite available for the paddle in the absence of wind, and will have less length and more beam than the above-mentioned type. A “*Nautilus*” canoe is about thirteen feet in length, two feet two inches in beam, and one foot three inches in depth. She is usually fitted with a “sliding keel,” which can be raised when paddling, or in shallow water, and lowered to increase her stability when she is under sail.

Fig. 4. —CRUISING CANOE.

RACING CANOES.

Of course canoes can be built, for sheer speed in paddling, much lighter, longer, and shallower than the build above described. They may run to eighteen feet in length, and two feet beam. But no sensible person will use them for

choice. If mere speed without sails is the desideratum, better at once have a rowing boat.

USELESSNESS OF RACING PADDLE CANOES.

The idea of a canoe is to be navigable in narrow, tortuous channels which a rowing boat cannot enter, or to cruise under canvas with the paddle in reserve. A canoe built for racing and paddling would be useless for either of the above purposes, and would offer all the disadvantages of canoeing without its legitimate recommendations. Those who go in for canoeing had better use a craft suitable for the legitimate purpose of a canoe, as explained above.

CANOEISTS SHOULD BE SWIMMERS.

It is, perhaps, almost needless to caution our readers that to go in a canoe, in water out of depth, without being a good swimmer, capable of reaching the shore in clothes after a sudden and unexpected immersion, would be suicidal folly and foolhardiness.

BOAT-SAILING.

IN dealing with this subject we do not pretend to give such instructions as would make our reader a practical yachtsman, even if he found himself capable of putting into practice all that he found in these pages. Our aim is simply to give such information as will, if duly acted upon, enable a lad to handle a small boat that will carry himself, and perhaps a friend or two, in an ordinary breeze, whether on river, lake, or sea. In dealing with our subject we endeavour to use the simplest language available, with due regard to nautical requirements.

There are two generic classes of rig—square and fore-and-aft. Square rig is found only in larger vessels. A brig is the smallest vessel that is fully square-rigged; often she is no bigger than a schooner; but by reason of her rig she can be handled by a smaller crew than a fore-and-aft vessel of the same tonnago, and hence the rig is in great demand in the merchant service.

There are hybrids between the brig and the fore-and-aft rig of a schooner—to wit, the brigantine, the ketch, the jackass brig—but none of them come within the scope of boys' sailing, so we need not enter into details respecting them. We shall confine our instructions to fore-and-aft rig. For small open boats the two best classes of rig are the spritsail and the lugsail; but there are also the lateen (and setter, which is akin to it), and the shoulder of mutton.

For larger craft, the fore-and-aft rigs are cutter, schooner, yawl, and lugger (the dandy rig is a variation of the yawl).

Small Open Boats for sailing should be about fourteen feet long and five feet in beam.

THE SPRITSAIL.

This sail is the simplest to handle: it is laced to the mast, and has a sharp peak (Fig. 1). It is elevated by means of the "sprit," which saves the use of gaff halyards. If the sail is small, not even "throat" or "main" halyards are needed to hoist it to the mast. This can be done with the hands. If the sail is too large for this, it must be hoisted against the mast by throat halyards. But in any case the sprit dispenses with the use of a gaff and of gaff halyards (which are further required besides throat halyards, to set the mainsail of a cutter, yawl, &c.). The sprit is a light spar, the top of which is set in the "eye" of the peak, a loop worked for the purpose. The sail is thereby lifted by hand until the heel of the sprit comes to the selvage strip, which is a "grommet" (or rope ring), which runs round the mast about one-fourth of the length of the lacing of the sail from the

heel of it. The grommet has a loop, and in this loop the heel of the sprit is slipped, and thus the sail is set. There is a rope attached to the lower end of the sail, nearest to the stern, and this rope is called the sheet. Till this sheet is secured the sail flaps to and fro in the wind. By fastening the sheet down on to the gunwale towards the stern of the boat, so as to stretch the sail longitudinally, more or less to the keel, the wind catches it, and so carries the boat with it.

The sail has to be trimmed, i.e., to be hauled in closer or let go freer, according to the direction of the wind as compared with the course held by the boat. The sail should be hauled just so close as is required to enable it to fill and draw freely, and then retained in this position until change of wind or course necessitates a tauter or slacker sheet.

The sheet should be held in the hand for safety's sake, especially by a tyro, so that in the event of any squall striking the boat the sheet may be instantly relaxed, or even let quite free. The sail should be fitted with brails, wherewith to furl it, unless it is so small that the sailor can furl it with his own hands in an instant. Even thus, brails are neater and handier to use.

Fig. 1.—BOAT WITH SPRITSAIL.

Brails are thin ropes fastened to the "throat" of the sail, where the lacing to the mast ends; thence brought round diagonally past the outer edge, a little lower down than midway, and so round the sail back to the mast, whence it started; then rove through a block and pulley, and thence passing down to the deck. A pull at this rope at once furls the sail, by clutching it up close to the mast.

The brail should always pass *inside* the sprit, between it and the sail, else the peak, remaining slightly open, catches the wind, and the sprit being bound to the mast half-way down, by the brails, has leverage to pull the boat over from that point; whereas, if the sprit is outside the brail, the leverage of the sprit acts upon its heel in the grommet, at a much lower elevation.

It is necessary for the sailor to let the sheet be held, or rove, at a point well aft (in fact, if he is at his helm he cannot do otherwise, unless he has long yoke lines). The reason is, that in order to counteract the lee-way, and falling off by the head, which the pressure of the sail at the mast causes, the sheet should pull the boat from a point well aft, so as to keep her up to the wind, and give her what is called "weather helm." A boat should have this quality, though not to too great excess. She then will hold her way not only with a wind abeam, but will also sail fairly close to the wind, and the sailor will thus be able to tack against a head wind.

We have spoken of holding the sail in the hand; but though this should be done in a small boat, the sheet may be passed round a belaying-pin or under a thwart, so as to steady it, and thus held, and hauled or slacked away accordingly as the sail requires trimming.

The spritsail works best with a beam wind, or a wind a point or two on the quarter; the boat thus always feels the wind, and the breeze keeps pace with her. When she is running before the wind she is running away from it, and cannot go faster than the wind, which she can with a beam wind and sufficient canvas.

GOING ABOUT.

So far the sailor has commenced a cruise. Suppose he wants to change his course. If he is beating against the wind and desires to change to the opposite tack, he "keeps away" by putting his helm "up" for an instant, so as to fill the sail well and to get his boat well in hand; then he puts his helm down gently, and hauls his sheet as close as he can, holding it, as the boat comes up with the eye of the wind, over the keel, and then over to the weather gunwale (that was). The operation of bringing the vessel's head nearer to the wind, by putting her helm down, is called "luffing." As the helm is kept down instead of being righted when the boat comes close to the wind, her head swings round, the wind catches the sail on the other side, and the sailor starts upon another tack (Fig. 2). This is called "going about." If he has the wind on the quarter he puts his helm up, and he shapes his course the direction he wishes to go, and lets the sail gybe over. Before doing so it is better to haul it close, to save the jerk; he can then slacken away when she feels the wind on the other quarter.

Fig. 2.—TACKLING.

Terms of the Helm.—The terms of the helm may be explained. They originate with the use of a tiller handle, and they apply to the direction in which the tiller handle points, or would point, if it were there. The steering may be performed with yoke lines (or with a wheel in larger vessels); still, the technical terms are the same.

Putting the tiller handle to "port" (or left) turns the blade of the rudder to starboard (or right), and makes the boat steer to the right. Putting the tiller handle to starboard has, of course, the converse effect. Hence "porting" the helm means steering to the right; and if a rudder line or wheel is used there is no porting in the matter, except in the technicality of the term.

In like manner weather-helm means a tiller handle pointed in the direction of the weather, or wind; helm "up," the handle pointed up wind; helm "down," *vice versa*; helm *a-lee*, handle away from the wind. In all these cases the direction of the blade, or directing portion of the helm, is opposite to that of the handle—or supposed handle—of the tiller.

The sailor must bear this apparent confusion of terms in mind, else he may go astray, and when told to put his helm "up," for instance (and having rudder lines, or wheel, and not a tiller handle), may forget that the order refers to the imaginary handle, and that the blade of his rudder should be pointed "down" for such an order.

The helmsman should sit on the weather (windward) side of the helm. Then, putting helm down always means pushing it away from him; and putting helm up means pulling the helm towards him.

The trim of the boat fore and aft affects her weather qualities, and the ballast affects her trim. The sailor himself is part of his ballast. When sailing close to the wind his vessel holds her course better if her ballast, or centre of gravity, is somewhat forward; and the farther the sailor can sit forward the easier she will sail. He can prove it by experiment. Let him haul his sheet on a steady wind, adjust his helm, till his boat sails true to her course; then let him move aft, without altering the sheet or helm, and she will fall off a trifle before the wind. Let him move forward, and she will come up somewhat to the wind.

A Foresail.—So far the sailor has cruised with one sail and one sheet only to manage. He may now set a foresail, and will do this better if his boat has a bowsprit, however small. The foresail is triangular (Fig. 3), has two sheets, one of which is in use at a time, to attach it to the gunwale, according to whether the boat is on the port or starboard tack.

This foresail requires shifting on each tack. The sheet is belayed to start with. When the boat has gone about the foresail sheet has to be let fly, and the other sheet belayed to the opposite side. If there is a second hand on board, as there should be if possible, with two sails and helm to manage, the forward hand holds the

Fig. 3.—BOAT WITH SPRITSAIL AND FORESAIL.



Fig. 4.—TACKLE OF MAIN SHEET.

foresail sheet tight and close to the mast, to catch the first breath of wind on the new tack; this brings the boat's head round quicker, and when she feels the wind the sheet is belayed on the opposite side. In wearing, with the wind on the quarter, the foresail sheet must not be let fly when going about, but hauled close until it feels the wind on the other tack, then slacked away and belayed.

With a foresail a larger spritsail will be wanted, to counterpoise the foresail, and the sheet should now be rove through a pulley and block, and the block attached to a short rope and ring, the latter running along an iron bar or horse standing on the counter of the boat (Fig. 4). The ring and block will play over from side to side, running along the bar according as the boat is on one or other tack, and the sheet can be held in the hand, or belayed (if belayed at all) within reach of the hand, so as to admit of being eased off at any moment.

So far the pupil has studied the simplest fore-and-aft rig, and has at the same time learnt the principle of the cutter rig during his use of the sprit together with the foresail, for, dynamically, the rig of the cutter is nothing more than this.

Practically there is a difference: the spritsail of the boat becomes the mainsail of the cutter. The cutter's is hoisted at the peak by halyards instead of by hand with the sprit; it is attached to a boom at the foot, and laced to a gaff at the head. The cutter also carries a jib—a sail on the same principle as the foresail, but set in front of it. She may also have a topsail, either jib



Fig. 5.—YAWL RIG.

bended or gaff, and, in a racing yacht, balloon topsails and spinnakers when racing. If, however, the reader is now able to sail a boat with sprit and foresail, he has mastered the broad principles required to understand the sailing of a cutter.

Yawl Rig.—The difference between a cutter and a schooner is that the latter has two masts, fore and main, both rigged fore and aft with a sail on the same principle as the cutter's mainsail, and set in a similar manner, but smaller in proportion to the hull. With schooner rig the open-boat sailor will not have to deal. But there is a half-way rig between cutter and schooner, called the yawl, and this can be applied to the open boat (Fig. 5).

The cutter's boom projects over the counter, or stern (Fig. 6); the yawl's does not. Instead of having so large a mainsail as the cutter, she has a mizen—a smaller mast—springing from the counter, and carrying a fore-and-aft sail of the lug class (Fig. 5).

This principle, with spritsails, instead of sails set by boom, gaff, and halyards, can be applied to the pleasure boat, and she can thereby carry a larger foresail and command more speed.



FIG. 6.—CUTTER RIG.

for her mainsail did not, like that of a cutter, formerly project over the counter, and therefore it is not reduced to make room for the mizen; consequently more canvas can be set forward to counterpoise the addition of the mizen. The mizen, though elevated by a sprit, requires to be attached at the foot to a bumkin, or small boom; the reason why appears. At the end of the bumkin is a double block; through this the sheets of the mizen are rove, and are passed back one to each end of the counter, to be belayed. But for the bumkin the sheet could not hold taut, for it projects beyond the reach of hand or arm.

In dynamical principle this is the yawl rig. In mode of setting the sail it differs, by reason of a sprit being used instead of gaff and halyards; also, the yawl proper has topsails and jib. But the boy who can manage the boat thus rigged has learnt the principles on which a yawl is handled. In going about with yawl rig, the mizen sheet pretty well takes care of itself, provided that on the new tack the boat has to be sailed a corresponding number of points from the wind to those on which she sailed on the preceding tack. But if she is to be sailed freer or closer than before, then the mizen sheet requires thinning accordingly.

In many small boats of this class, the mizen is a lug, although the mainsail is



FIG. 7. BOAT WITH LUGSAIL.

a spritsail. If so, of course the mizen then requires no sprit, but is hoisted in the manner below described for lugsails. In a yawl proper, as stated above, the mizen is generally a lug, or else a dandy. In wearing, the same precaution has to be taken with the mizen as with the main when the sail gybes. In running before the wind the yawl rig comes into play with much advantage. The mizen and main are spread out like butterfly's wings, one on each side of the boat, so as to help to keep her on even keel and to ease the helm, which is more or less hard a-weather when a fore-and-aft-rigged vessel is running. The wind being inconstant in force, it is well to boom out the main and mizen sails (especially the mainsail) with an oar when running before the wind, to prevent the sail from slacking back when in a lee-way, when the wind falls, and then perhaps gybing unexpectedly and with a jerk to the opposite side. Such an event might carry something away, even if it did not cause a capsize. So far we have shown the young sailor how, with the sprit as a substitute for yard and halyards, he may enjoy in miniature the feeling of cutter or yawl sailing.

LUGSAILS.

We now come to the lugsail (Fig. 7).

This is not so handy in many ways to a beginner as a sprit. It has two sheets to be managed instead of one, and is not so easily handled in going about, in consequence of what is called "dipping" the lug. It also requires more elaborate tackle to set it.

The original lugsail was square, laced to a yard near the top of the mast, and with a sheet at each end of the foot, and each sheet belayed or held separately. Modern lugsails have more or less peak, and the yard is not suspended from its centre, but at a distance therefrom corresponding with the angle of the peak (about one-third). The yard is hoisted by halyards rove through a sheave at the masthead, and attached to the yard at the point above mentioned. The sheet at the forefoot of the sail is boused (or fastened taut) through a thimble, and made fast at the foot of the mast. The other sheet is held or belayed (as that of the spritsail) when the sail is once set. The peak of the sail is elevated by the counter pull of the halyards against the sheet boused at the foot of the mast. The yard lies forward of the mast. In going about the lug has to be "dipped," to bring the yard round to the other side of the mast; this requires two persons, and is a difficult performance for tyros. Fishermen working a lug single-handed often lower the sail, unhook the yard from the traveller, shift it while down, attach the sail, and hoist it again. A lugger proper has no boom, and fishing luggers have none. By rights a yawl also has no boom, and if it has one it becomes a "dandy"; but in yachts all yawls have booms, while retaining the name of yawl.

The lugsail while set is handier for the vessel itself than the sprit, and commands more speed; but it will be seen that it is more difficult to manage when going about, especially in a heavy sea-way. The sailor, when he has mastered a single lug, may add a mizen lug, just as he adds a mizen sprit, and so obtain an adaptation of the dynamical principle of the yawl. He cannot set a foresail, but may rig a bowsprit, and set a jib in addition.

(N.B.—What are called "Yarmouth yawls" are luggers with two large masts carrying main and foretop respectively, and one mizen; also a jib in fine weather.)

With this explanation, what has been said generally of sailing with spritsails may be applied to lugsails.

Lateen Rig.—The Lateen, used in Norfolk and in the Mediterranean, is a lug dynamically, but is shaped thus (Fig. 8), and, being laced to a boom, does not

require to be dipped when going about, but revolves upon the mast of itself, and sails free in front or behind it,—a plan that has much to recommend it.

Settee Rig.—The Settee, seldom seen in Britain, is similar to the lateen, but the front angle is cut off, and so gives room for a bowsprit and jib-sail. A lateen-rigged boat may carry a small mizen laced to the mast and to a yard, and attached to a boom, and hoisted like a cutter's mainsail, by a halyard through a block at the masthead and attached to the yard, the boom being boused down taut.

Fig. 8. BOAT WITH LATEEN.

Improved Lug.—The lateen sail seems to have suggested an improved style of lug now sometimes in use in private boats and yachts. The foot of the lug is laced to a boom, and is boused down tight by means of a tackle attached to the boom about a quarter of its length from the fore-end, and drawn down to the foot of the mast. The sail thus revolves freely, and can be sailed on either side of the mast, whether main or mizen. No jib is thus used, for the fore-foot of the sail projects too much from the mast.

REEFING.

The sailor should learn how to reef his sail when the force of the wind is too great to admit of his carrying full canvas (Fig. 9). He will note the sail spread full, and then reefed, with the reef points. Let him be careful to tie his reef knots thus (Fig. 10, A), not thus (Fig. 10, B), for these are "grannies," and must slip undone easily, like the former when the two bores of the knot are pulled apart, by pushing the ends against them.

FIG. 9.—SAIL REEFED.

CANOE SAILING.

The most practical rig for a canoe is that elaborated by Mr. W. Baden Powell, who has no superior at this miniature yacht game, and whose various canoes have one and all achieved victories in his hands which they often fail to maintain when they pass to other and less experienced owners. The nautilus type of canoe owes its invention to Mr. Powell. The rig of the nautilus type consists of two working lugsails on the balance principle (above described), laced to booms, and boused down taut to the foot of main and mizen masts (Fig. 11). The sails have a very high peak, and there is no foresail or jib. The mainmast is set farther forward than in an ordinary lugger. In canoe-racing under sail a spinnaker is sometimes set, and even a small topsail.

However, so much skill and knowledge of seamanship are required before a sailor can set canvas of this sort from the recumbent position necessary in a canoe, that we doubt if mere book-work would teach a lad how to handle it. It will suffice here to state what the most approved rig for canoe sailing has been

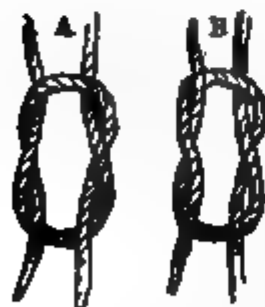


Fig. 10.—REEF KNOT (A) AND GRANNY (B)

found to be. His two lugsails, above described, he can hoist from the "well" as he lies in it; but if he desires to study the science of sailing a canoe with all the appliances in miniature of modern yacht-racing, he will learn more in half-an-hour's practical instruction from a yachtsman than he could in folios of book instruction, which would run beyond our available space. Besides, before he could aspire to such fame, he would probably have acquired more knowledge on special points than this work professes to convey.

The Canoe Club does much to teach the art of yachting and yacht racing in miniature; and though the tyro must not expect to be able at once to handle canvas of the dimensions which the racing experts can set with safety, he may learn much, especially if he is not too proud to take hints from what he sees done around him. Many ambitious canoeists buy eagerly any canoe which has won a race or match of importance, and fancy that the possession of such a craft is a passport to future victory. They are generally cruelly undeceived. No doubt the new purchase has admirable qualities, and is capable of winning when handled to the best advantage, but the skill of the sailor often has even more to do with victory than the weather, or running or reaching qualities of the craft, and when the cutter passes into hands which at the best of times are less skilful than those of her former owner, and which have not been accustomed to her peculiarities, there comes a woful falling-off in performance, and the purchaser then fancies that somehow he has been "done" over his expected bargain. The canoeist yachtsman, from his recumbent position, is placed so much less advantageously than the sailor of the open boat, for handling his sails, that a far greater knowledge and practice in handling are necessary in the one than in the other pursuit. The tyro may get on to his own satisfaction, slowly but surely, when simply cruising; but when he essays racing, he will find that in the celerity of setting his sails, and science in trimming them and his boat, he has much to learn from the masters of the craft.

Fig. 11.—NAUTILUS CANOE RIG.

In conclusion, we append a few words of advice, applicable to all sailing.

Keep a good look-out.

If you belay your sheet, see that the spare rope lies coiled, and not tangled round an oar or spar, so that it may run off free when suddenly let go to ease the boat in a squall.

Better belay as little as possible, especially in inland lakes; on the open sea a coming squall can be seen. Inland, it strikes suddenly from above, off highlands, like a box on the ear.

When sailing close hauled—i.e., the sheet hauled close—to sail close to the wind, keep her "full and by," i.e., don't let the sails shiver, but let them fill and draw well.

If you find yourself caught in a squall, luff, so as to throw your boat's head with the wind and to ease the lateral pressure of the sail, and then lower or furl sail accordingly.

See that all ropes, sheets, halyards alike are coiled neatly, and not lying in a tangle at the bottom of the boat.

Don't think of sailing until you can swim well.

GENERAL HINTS ON TRAINING.

ALTHOUGH due reference has been made in the papers on rowing, swimming, and athletics, to the correct system of training for each of those pursuits, a few general hints on preparing for such sports cannot be out of place in a work of this description.

In the first place, it cannot be too strongly impressed upon any who read these remarks that violent and sudden change from the ordinary course of life to a *régime* which is opposed to it is very likely to prove injurious to the health of the person who makes this sudden alteration in his mode of living. Bearing this in mind, those who propose to train themselves for any special event should prepare for the course they are about to pursue; and a timely dose of medicine has always a beneficial result at the commencement of training—the action of the medicine clears the inside of all obstructions, aids digestion, and generally improves the tone of the athlete's stomach. This is of the highest importance, as sound refreshing sleep can only be obtained by those whose general health is good, and if a man in training cannot rest at night, much of the strength that is so essential to his success will assuredly be lost.

Having duly worked off the effects of the medicine (rhubarb or blue pills and a black draught are about the best things to take), the man who is in training can slowly but surely increase the amount of exercise which he daily takes, at the same time gradually renouncing all fattening and indigestible food, and also the homely pipe and alcoholic drinks. At the end of four or five days strict training should commence, and in many cases a second dose of medicine will benefit the athlete, and help to reduce his superfluous fat. One thing, however, should never be lost sight of, and that is, that very much—almost everything, in fact—depends upon the natural constitution of the person who is training. Some men will not only stand, but positively require, an amount of hard work and dieting which would incapacitate another, and therefore much must be left to the *good sense* of the trainer or the person who is being trained. Of course, when a trainer is engaged much of the responsibility rests with him; but under any circumstances a man himself is sure to be the first to feel that his strength is failing or that his health is suffering, and then precautions should at once be taken to prevent the progress of this lassitude, or he will break down.

Sweating is necessary in the case of certain men in order to reduce their fat, and these sweatings may be either artificial or natural. Artificial sweating can be brought about by the use of sweating-powders at bed-time, but these weaken the men too much, and render them liable to take cold; or else the athletes can be enveloped in a damp sheet wrung out in cold water, and then be well enveloped in blankets and laid on a hard sofa or mattress. In a few minutes, after being thus laid out, a profuse perspiration breaks out, and the man can be kept enveloped in his rugs for twenty minutes or half-an-hour, though, of course, much depends upon his power to stand the strain caused by the perspiration. After he is unpacked he should be douched with cold water and rubbed dry with rough towels, good care being taken that he should be kept out of all draughts and there is no chance of his taking cold. Natural sweating is caused by extra exertion under extra clothing, care being at the same time taken to envelop those parts of the body which are very fat with more clothing than the other portions. Two pairs of trousers and a thick woollen jersey will, if the athlete

takes a good long walk, soon help to reduce his weight; and on his return home he should have a cold douche and rub down, as recommended above. It is not desirable to muffle up the throat more than is positively necessary, as this tends to weaken that sensitive organ and give the man a cold.

Violent sweatings are not often necessary, but after they have been indulged in every care should be taken to guard against the chances of catching cold. The man should be well rubbed down with a rough dry towel, and, unless extremely delicate in constitution, he may afterwards be sponged all over with cold water; subsequently to this he must again be rubbed dry with rough towels. Draughts must be carefully avoided, and sitting in damp clothes is especially injurious to a man in training. It must be remembered that when the pores of the body are acting freely a man is peculiarly susceptible to chills, and a chill "thickens his wind" and renders heavy exercise almost impossible, besides reducing his strength considerably. It is, therefore, very foolish to run the risk of taking cold, and a sudden change from a high temperature to a low one is not, therefore, the act of a wise man when he is in training.

As regards diet, good wholesome food only should be taken, and under any circumstances it should be well masticated by those who have to eat it. Square lumps of meat, bolted in a hurry, must disagree with the swallower, and indigestion causes uneasiness, which is prejudicial to getting into condition.

The amount of drink, too, *must* be *limited* if a man means to do himself and his system of training anything like justice. In ordinary life people drink by far too much, and the quantity allowed a person in hard training should be as small as possible. Great relief from thirst can be gained by rinsing out the mouth with water, and by bathing the face and hands.

Exercise is an important point, and so is the amount of rest which has to be taken. With reference to the former, it may generally be safely left either to the trainer or the party trained; at all events, it has been pretty well gone into in the articles already alluded to above. Too much rest is quite as bad as too little, and it may be taken that from eight and a half to nine and a half hours is enough for any man in training, and if he wants to get into good condition he should never be out of bed at eleven o'clock p.m. During his waking hours the athlete should keep himself amused, as, if his mind gets agitated or worried by business affairs his "fitness" is greatly retarded, and it should be remembered that a considerable portion of his time should be spent in the open air if the season and weather are at all propitious.

Sunday should always be a day of rest to men in training—not of absolute repose, most decidedly, but the work on a Sunday is generally reduced to the walk before breakfast and a good long walk in the course of the afternoon. Nothing can be much more acceptable to the hard-worked athlete than the comparative ease which he enjoys on this day, especially, as in many instances, a slight, very slight, relaxation in diet is permitted by the trainer. As a rule, when sensible persons are being trained, these Sunday privileges are not abused, and the men get up and to hard work on the Monday morning all the better in health and spirits for the ease they have experienced.

General health is an item of the greatest importance, and in training the state of the bowels is very often a source of trouble to those concerned. Usually an increase in the quantity of vegetables which is daily consumed will of itself do great service when the bowels are confined; and a little chalk is useful when the reverse is the case. However, under any circumstances the advice of some proper authority is most desirable, and it should be borne in mind that, time being short, perfect health should not only be restored with as little delay as possible, but the training diet should not be altered to any great extent unless such a change is positively imperative. Boils, blisters, and casualties have been

referred to before, and it can only be repeated that it is always well to enlist medical assistance *promptly* when in difficulty.

Lastly, the duration of training should be considered, for too long a spell of this sort of life has often done much to injure the chances of a man's success. If over-trained he gets listless, weak, and "stale," whereas, if he had not been so hardly worked, or if he had trained for a few days less, he would have been in the pink of condition. Roughly speaking, four weeks' hard training is enough for any but *very high* class competitions, then the course may extend to six weeks. Training over, let the athlete gradually resume his ordinary mode of life, and in three or four days after his race he can return with safety to his old routine, benefited rather than injured in health by the privations and exertions he has undergone. Hard training is, however, an impossible matter in the case of many amateurs who have to attend to their business during the day, and have therefore to get themselves into condition as best they can, and take their constitutionals and exercise under great disadvantages. In the case of a person who is confined in an office during the day, it is perhaps better if he rises half an hour earlier than he would otherwise do, and after a short walk to empty his stomach, take his breakfast, half an hour after which he can set off for a long constitutional. If resident in the suburbs of a town he can walk sharply to his office, and if he can arrange for a change of clothes when he reaches it, a great advantage will be gained by so doing. In the middle of the day he can take his lunch, a light one, and a walk, and in the afternoon, after office hours, his regular "grind," either on the river or the running path, as the case may be. In the winter months it is desirable for him to take this last-mentioned portion of his exercise in the morning, if he is usually late at his business, for practising in the dark is objectionable, as it increases the difficulty of the coach. In such cases it must be remembered that no opportunity should be lost of getting into the fresh air and taking walking exercise, though every precaution should be used, that can be used, to prevent a chill when the body is heated. A man can generally begin to feel the effects of training after he has been at it for ten days or a fortnight. About this time his spirits improve, and he feels light-hearted and ready for his work; but this is the time for caution, as he will, in his zeal, be likely to overdo his work, and be stale and unfit before the day of the race. In many cases, too, his rest is not as good as it has been, and almost always his appetite becomes impaired; sometimes an abhorrence of his simple diet takes possession of him, and he will eat nothing, so to speak. Under such circumstances he should be eased in his work, and a little change of diet may be prescribed for him, such as a plain roast chicken for his dinner, or a little fried fish. An egg beaten up with sherry, in the middle of the day, may be taken to increase his strength, and if very much below the proper pitch, one glass of champagne at his dinner will often do much towards setting him up and recruiting his health and spirits. Every pains must also be taken to keep his spirits up, as when a man begins to feel weak it generally preys upon his mind and causes him to think himself in a worse state than he really is.

MINOR OUT-DOOR GAMES.

BALL GAMES.

GAMES with balls are as ancient as civilisation itself; they have always been recommended as affording healthy recreation and amusement to the young, as well as to adults. The requisites for these games are few and inexpensive, and it is very desirable that an intelligent acquaintance with the varieties of games played with the ball should be easily obtainable by all. It is hoped, therefore, that the descriptions of the Ball Games given in the following pages may be found useful by those desiring to participate in such amusements, and at the same time help them to infuse variety into their play.

ALL FIVES.

See "Sevens."

BALLOON, OR BOUNCING BALL.

The balloon ball is made of gutta-percha, is hollow, and usually painted some bright colour or colours. It is soft, and therefore makes a capital toy for young children. The ball is air-tight, and being of an elastic material makes a good bouncing ball, for which purpose, indeed, it is best suited. It is a safe toy in-doors or out, being so soft and light that it can hurt no one and endangers the safety of no windows. A balloon ball may be kept bouncing a long time by a small child after short practice. The ball should be grasped firmly in the right hand and thrown to the ground with just that amount of force that will make it rebound to a height about on a level with the player's elbow. When at that height the ball should be sharply struck with the open hand and sent again to the ground, and so on again with each rebound until the player misses, when the ball should be passed on for the ingenuity of the next young player, to be exercised in a similar manner.

Balloon balls are made of almost all sizes, and one of the largest size makes a first-rate football for the younger children. It is easily kicked to a considerable distance, and may be well used in miniature football games before youngsters are troubled as to "Rugby" or "Association" rules, and when they care more to see the result of each individual kick. Rough usage, however, very soon destroys these balls, and it is therefore well that they are generally despised by bigger boys, and so left to the more appreciated service of children.

Balloon ball, as played in some countries, consists in knocking balls of the above description from player to player without catching them or allowing them to touch the ground. This version of the game is very popular in France and Italy, but is little known elsewhere. The game played in this way is of great antiquity; but inasmuch as the balls now known as "balloons," and made of so soft and elastic a material as gutta-percha, were unknown, the game was then more for adults than for boys. The ball used was generally a distended bullock's bladder covered with leather, and to protect the players the hand and lower part of the arm were covered with a leathern gauntlet. Instead of playing the ball in the air, it was sometimes played on a level floor, but the hand was the only weapon used for knocking the ball.

Balloon balls are quite a distinct toy from the diminutive air-balloons sold by pedlars and street merchants on holidays, and which, at other times, may occasionally be bought in the streets, but rarely in toy-shops, as they are of so perishable a nature as not to be often kept. These air-balloons are made by forcibly distending small elastic bladders to their utmost extent, and fastening the bladders air-tight at the mouth when fully distended. From its lightness and the extent of surface it presents to the atmosphere, this toy will in a very slight wind float about balloon-fashion, but to prevent its loss by being blown quite away it should be attached to a piece of string or cotton, the end of which should be secured by the owner of the balloon.

BOWLING.

Bowling is little more than making practice for cricket and other similar games. A wicket should be placed, the bowlers taking their stations at such a distance therefrom as to deliver the ball when at about twenty or twenty-two yards from the wicket. The players in turn bowl at the wicket, a successful ball entitling the bowler to another try, but every time the bowler fails to hit the wicket with the ball the ball is passed on to the next player. The true art of bowling is not to be learned from books; it, like other arts and sciences, has its professors, who should be solicited for lessons. Much may, however, be learnt by watching others bowl. The styles of bowling are many and various; under-hand and over-hand, slow and fast, lobs and pitches, are a few varieties of the art.

A version of Bowling sometimes seen in the North of England is that of covering a given length of level ground in as few as possible underhand casts of the ball, the width of the ground being limited to a few yards.

The following practice is sometimes known as Bowling:—Four players, among whom are three balls, place themselves at four corners, the balls being passed round from player to player as quickly as possible. The balls may be thrown, pitched, or bowled.

CATCH BALL.

As its name implies, the object of this game is to catch a thrown ball, an apparently very simple feat to perform. The game may be varied in many ways. It may be played by almost any number of players, who may place themselves as they please. The best game at Catch Ball is arranged by placing the players at different points in the field or playground. The ball is then to be taken by any one player and thrown to any other, who, after having caught the ball, throws it on to any other player he may select, and so on. Instead of this promiscuous throwing, the ball is sometimes thrown regularly round to each player in succession. Points should be lost, according to the decision of the captain or umpire, to the player who unfairly throws, or to him who fails to catch a fairly thrown ball. The promiscuous throwing of the ball to the various players makes good fielding practice for cricket, encouraging smart throwing up and keeping the attention of all fixed on the ball, lest when thrown to any individual it should be missed. A dull or inattentive boy often votes this game slow.

Another version of Catch Ball is that of throwing the ball perpendicularly to as great a height as possible, the player throwing the ball naming the one to catch it. The game played in this way is far inferior in fun and spirit, as well as general utility, to the other method, and, indeed, as far as practice for the more important field sports is concerned, is practically useless.

DAYS OF THE WEEK.

This game has various cognomens. It is known as Days of the Week; Monday, Tuesday, Wednesday; Here Goes up for Monday; and no doubt by other equally expressive names.

The best kind of ball for playing this, and indeed most of the remaining ball games described in this section, is the small white ball, usually stuffed with broken cork or some similar material, that may be purchased at a very small cost at any respectable toy-shop.

The game is to be played by seven boys, or less, each boy, according to the number playing, taking for his name that of one or more days of the week. The game must be played against the side of a house or a high wall, opposite to which the players range themselves. Sunday, as a general rule (though any one may do so), then takes the ball, and throws it high against the wall, at the same time calling aloud the day-name of any one player, whose duty it is to catch the ball before it reaches the ground, the other players, in the meanwhile, running away to a short distance, and ready to take a further run, should the ball not be caught by the player called. Upon the ball being duly caught, it is thrown by the catcher to the wall as before, the name of some other player being called, and so on again and again, so long as the ball is not missed. Should, however, any player, when called, miss the catch he loses a point, or "egg," as it is customarily termed, and he has to pick up the ball and throw it at one of the other players, all of whom by this time will have scampered away to a distance. If the ball hits any of them, that player also loses a point, and has to serve the ball as at the commencement of the game. If, however, the ball, when thrown, hits no one, the player who missed the catch serves. Three eggs, or points, put a player out, the one last in being the winner, and he is the only one who administers, but himself escapes, punishment, which, by the way, is not to hearty lads a very serious matter.

The punishment inflicted is arranged in the following manner:—The last player out takes the ball, and leaning on his left hand, with his arm outstretched against the wall, throws the ball with his right hand as hard as he possibly can against the wall, sending the ball as far from the wall as his strength and skill can make it rebound. The winner then picks up the ball where it rests, and proceeding to a point straight in front of the loser, and at a distance from the wall equal to that at which the ball rested, is entitled to have three throws at the loser's right hand placed on the wall at a level with his shoulder, or should the loser prefer, he may take his punishment by turning his face to the wall, and letting the winner have the three throws at his back. The winner is in this manner entitled to punish all the losers.

Any winner, of course, who is content with the laurels gained in winning the game may waive his right to administer punishment, and he will generally find more fun and satisfaction in so doing, and in calling a fresh game, than by claiming all the privileges to which he is entitled.

DOUTEE STOOL.

Doutee Stool, or Stool Ball, is a game shrouded in some degree of mystery. Some descriptions of the game are indeed of so hazy a nature as to put it beyond the understanding of all but a very select few. It appears, however, to be an ancient ball game, and is by name referred to in certain of the Early English Classics as a common out-of-door ball game. The description of the game that appears the most reasonable, and apparently that which gave the game its name of Stool Ball, is the following:—The game requires but two

players, the one taking the ball, the other a stool; it is then the duty of the one with the ball to throw it at the stool, which should have been placed at some distance off on the ground, while the other player defends the stool with one of his hands, as the cricketer's wicket is defended with his bat; each successful defence scores one to the defender of the stool, whereas, should the stool be hit, the players change places and duties.

Stools is a variety of the same game, there being, in this case, two or more stools placed at considerable but equal distances apart. The dealer or out-player then throws the ball in succession at the various stools, at each of which a player must be stationed. The player at whose stool the ball is thrown endeavours to hit it as explained above, and so soon as the ball is hit the various players change positions by running to some other stool, and if while the change in places is being effected the dealer recovers the ball in time to throw it at and to hit any one of the runners, the runner so hit changes places with the dealer. If the dealer's attack on any one stool is successful, the unlucky defender of that stool, of course, is out, and the dealer comes in instead. In this game, as in Doutee Stool, if any one player strikes a ball so that it is caught by the dealer, before the ball touches the ground, such player is out.

EGG HAT.

This is a capital game for any number of lads up to a dozen or fifteen. It affords good sport in running and throwing, and may indeed be considered much better for the players' constitution and health than for the well-being of their, for the time, discarded head-gear.

Each boy places his cap against a wall, so that together the caps form a row, they being placed so as just to touch each other; a line at a distance of five or six yards from the row of caps should then be drawn, it being first seen that all the caps are so placed that a ball may readily be thrown, at the distance named, into any one of them. Some player is then selected to pitch, whose duty it is to throw the ball into any of the caps—for his own sake carefully avoiding his own. The owner of the cap into which the ball is thrown must immediately rush to the cap, snatch out the ball, and then do his best to throw the ball so as to hit one or other of his fellow players, all of whom will, of course, in the meantime, have made the best use possible of their legs to secure a safe distance. In the event of the ball striking any boy, a stone or pebble, called, and after which the game is named, an "egg," is placed in his cap, and he takes the pitch; if, however, all are so fortunate as to escape being hit by the ball, then he who threw the ball scores one to the bad in a similar manner, and himself has the task of proceeding with the pitch as first explained, and so on the game proceeds until some player scores three "eggs," and has then to resume his cap, temporarily leaving the game, and is termed "out." The game then again goes forward until all but one, the winner, are out.

An "egg" should be charged for every pitch that results in missing all the caps; but if the ball remains to be pitched by a player already debited with the full number of "eggs," he continues playing until he succeeds in placing the ball in some other player's cap; upon this being accomplished, he retires as already set forth. It may be agreed among the players that three throws should be allowed before the "egg" is charged to the account of the thrower. The winner may claim to punish the losers as is described under the heading of Days of the Week.

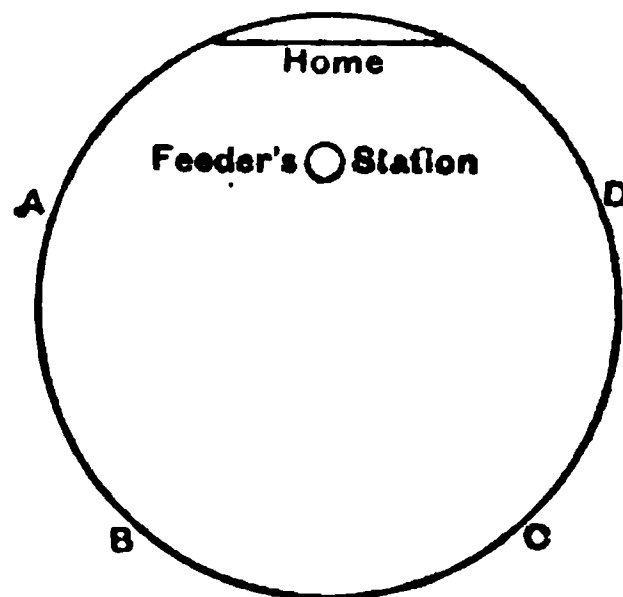
FEEDER.

This is a good round game for summer or winter, and for any out-of-door weather. With the exception of one who is termed "feeder" all the players

are in. Before play is commenced, a space of ground called "home," and sufficiently large to accommodate all the "ins," should be marked out, and then "bases" or "rests" at distances of from twelve to twenty yards apart, verging round from home back again to home, in the manner shown in the diagram, should be arranged, each "base" being conspicuously marked by a post, large stone-wicket, or any convenient object. The rests or bases should number at least not more than one less than the players who are in.

Feeder is then to be selected, and he places himself two or three yards in front of home, and prepares to feed by giving a fair pitch of the ball to the first of the other players, who should be standing in "home" at the nearest point to the base marked A, the other players being ranged in a line behind him, or to his left hand. The object of the player is to strike the ball, when fed, in such a way and to such a distance as to enable him to make at least one base, and as many more as possible, before the ball can be recovered by the feeder, as feeder may throw the ball, when in his possession, at any player not at home, or at any one of the different bases, and if such a player should be hit, he takes feeder's place, and feeder runs home. The first player having been fed and having made one or more bases safely, the second player is fed and runs as before, and so on.

Although all players may be at home at one time, no more than one player can occupy the same base at the same time, nor may any player pass by an occupied base. It therefore follows, if player No. 1 has not vacated the base A when player No. 2 strikes the ball, player No. 1 is then, at all risks, bound to make for base B, and so on farther, when again player No. 3 is fed.



PLAN OF FEEDER.

Should a player strike a ball so that it is caught by feeder, the latter is released. This is also the case if a player strikes at, but misses, a ball. No player, although bound to run if he strikes a ball never so gently, is bound to strike at any ball unless he chooses; and it will be apparent that this rule is necessary to compel the player acting as feeder to deliver fair balls. On the other hand, however, no player may leave a base while feeder is in the act of serving the ball, as when refused by a player it is considered "dead."

A round stick or a small bat may be used by the players for striking, but this is not essential, the open hand being a more ready and a sufficiently serviceable weapon. When a stick or bat, however, is used, it must, when the ball has been hit, be dropped and left at home for the next player.

This game resembles in many particulars the game of Rounders (which see).

FOUR CORNERS.

Four Corners is a game similar in principle to Feeder. It consists of players who are in and one player who is out. Home should be made in a circle in the middle of the field or playground, the four corners being made the bases. The player who is out changes places with one or other of the players that are in, under the same circumstances and conditions as those explained in detail in describing the game of Feeder. If the ground is small, it may be made a condition that the player when he has struck the ball shall run two corners instead of only one.

There is another version of the game which is best when played with five players, four taking possession of the corners, the fifth stationing himself where he chooses, but with the ball, and always feeding the player standing at corner No. 1. Every player must then run from one corner on to the next whenever the ball is struck, and during the running all are liable to be thrown at and knocked out. It will be seen that each individual player should thus get every fourth ball served to him.

A game at skittles is also known by the same name.

HERE GOES UP FOR MONDAY, and MONDAY, TUESDAY, WEDNESDAY.

See "Days of the Week."

NINE HOLES.

This game is very similar to, and quite as good as, Egg Hat ; it is indeed better for the hat. It requires nine players, but if any boy is prepared to take on himself more than a ninth part of the responsibility, there may be less, or it is not necessary that the full number of holes be used.

Nine good-sized holes should be made in the ground against a wall, the holes being sufficiently large to make it an easy matter to roll a ball into any of them at a distance of nine or ten feet. Three small stones or pebbles are to be placed in each hole, and the holes are to be called respectively 1, 2, 3, 4, 5, 6, 7, 8, 9, commencing from the left-hand side. The players, each taking some one of the corresponding numbers, have to look after the holes so allotted to them. Player No. 1 then stands at a line drawn nine or ten feet from the holes, and rolls or bowls the ball, which must neither be thrown nor pitched, into one or other of the holes. If he fails to send the ball into any hole, he loses one from his "eggs," that is, one pebble should be taken from hole No. 1. When the ball falls into any hole, the boy with the corresponding number picks it out as speedily as possible, while all the remaining players will be scampering quickly away ; he then throws the ball at one or other of the players, who, if hit, throws at some other player, and so on, until some player misses. Each player hit loses one, the player missing losing one also for the miss. The "eggs" or pebbles in any one hole being exhausted, that player is out. The last in wins, and, if he chooses, is entitled to inflict punishment all round similar to that described in Days of the Week.

PALL MALL.

This game is believed to be entirely extinct. Its best-known memorial is the fashionable street in London bearing its name. It appears, however, that the place for playing was known as the "mall," and the stick employed the "pall mall." The game of Croquet is undoubtedly a revival and development of the ancient game of Pall Mall ; but indeed the latter, because of its simplicity, seems worthy of revival for its own sake. In Cotgrave's Dictionary (1632) the game, as popularly played in the time of the Stuarts, is described in the following words :—"Paille Maille is a game wherein a round box bowle is with a mallet struck through a high arch of yron (standing at either end of an ally), which he that can do at the fewest blowes, or at the number agreed on, wins."

In France there is a game of "Mall" indulged in that more nearly resembles the modern English game of Croquet. The following description of the game has been obtained from the "Académie Universelle des Jeux," and although the game is not now so popular as it was at the commencement of the century, it may still be seen in many of the rural districts. The game is played on a prepared piece of level ground or lawn, enclosed by a low stone wall, or by wooden planks. The ground is usually from 150 to 200 yards long, and 10 or 12

broad. A hoop is placed at each end of the ground, and in the centre is an iron or wooden peg. The game is best adapted for two players only, each one of whom takes up his position at opposite ends of the ground. The players are each supplied with a wooden ball and mallet, and the object of the game is to knock the ball with the mallet from one end of the ground through the hoop at the opposite end, and then to hit the centre peg with the ball. The player who accomplishes this in the smallest number of tries wins the game.

RING BALL.

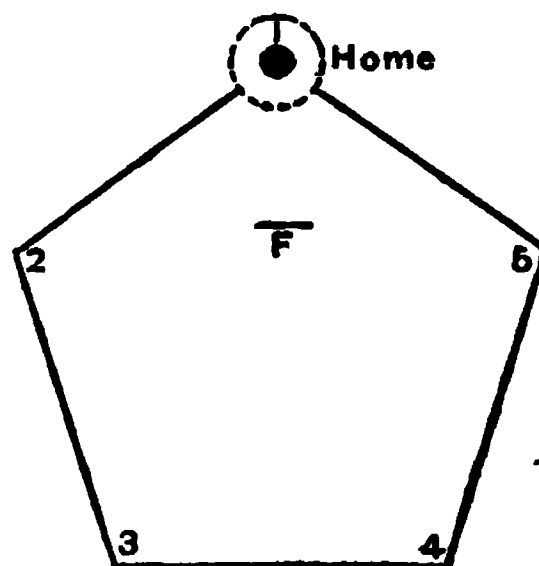
Ring Ball is a most ancient game, and is doubtless the old game of Pall Mall in its first development towards the modern game of Croquet.

The game of Ring Ball has to be played on a ground or alley appropriated to the purpose. A wooden ball about three inches to three inches and a half in diameter has to be driven from one end of the ground to the other, through an arch or arches, with a mallet three feet to three feet six inches long. The game, so far, resembles that described above as Pall Mall, but in addition to the iron arch or arches, there is a ring placed in the ground about two-thirds of the way towards the far end of the alley. This ring is differently marked on its front and back. is placed upright, and turns upon a swivel, so that anything touching the sides of the ring causes it to turn. The ball is started from home as in Pall Mall, and has to be driven with the mallet through the ring in addition to the arches, and it is only lawful for the ball to pass through the ring, entering it first by the side originally turned towards the top of the ground. The player who first succeeds in passing his ball through the ring and arch or arches, or so succeeds in the smallest number of blows, wins the game.

ROUNDERS.

Rounders is the king of all the ball games described under the heading of Minor Out-door Sports. It is the direct ancestor of Base Ball, and out of the English practice at Rounders have the laws of the United States National Association of Base Ball Clubs been formulated. The more elaborate game, which is identical in all essential features with Base Ball, is governed by a code of strict laws drawn up by the National Rounders Association, of which Mr. W. H. Hivoy, 15, Ford Street, Liverpool, is the Hon. Secretary.

For a perfect game at Rounders there should be eighteen players, divided into nine on each side, the "ins" and the "outs." Bases, out and home, should be planned as shown in the game of Feeder, of which game, indeed, Rounders is a development. In the diagram F is feeder; 1, home base; 2, 3, 4, 5, the bases that are to be successively run to. Should, however, the players on each side be so few as five, the out bases should not number more than three. The captains on the respective sides toss for the choice of first innings, the losers' side acting as fielders, the "in" side arranging themselves at the home base. The fielders select one of their number to act as "pitcher" or "feeder," the others placing themselves round the field under his direction to assist in putting out their opponents. A bat somewhat of the shape of a battledore, but smaller, should be provided, with which the striker is to hit the ball. The pitch is given, as in the game of Feeder,



PLAN OF ROUNDERS.

to the first one of the "in" side that offers himself and to the others in succession, every player having the option to refuse as many balls as he chooses, or three balls only if so arranged at the commencement of the game. The running from base to base proceeds as in Feeder, except that more speed and care have to be exhibited, as the pitcher in this game has the whole of his field to take the ball when hit, and to throw it at the players as they run from base to base or home.

Any striker hitting the ball so that it is caught by any one of the fielders is out; any of the "in" party being hit by the ball when absent from home or away from a base is out. No more than one player may at the same time occupy the same base, and all the bases are to be run in regular order.

The ball is "dead" when it leaves the pitcher's hand until it has been struck at by the player, and no one may move from the base he is occupying while the ball is dead. A fielder should, however, be placed close to the home base to take advantage of any breach of this law, as, although no player may improve his position while the ball is dead, he is liable to be thrown at and made "out" if hit when away from a base. Each player as he strikes the ball must drop the bat for the next player before running.

The players of the "in" side when reduced to two may select one of themselves to take what is technically termed "three hits for a rounder," the one not selected retiring. The selected one has then to be served with the ball until he has had three trial hits thereof, and on the third hit or attempted hit, if he has not previously tried for his rounder, must run from home round to every base in succession and back again to home, without either being hit with the ball or without the ball being grounded at home during his absence while running. Grounding the ball at home consists in placing the ball at home when "home" is otherwise empty. If the rounder is successfully made the side is again all in, and the game proceeds as before; if, on the contrary, the rounder be lost, the sides change places.

A side is out at any time if a ball be grounded at home when no player is there. Excepting only for the rounder hit, a player must run if he strikes at a ball whether he succeeds in hitting it or no, and if he should strike the ball behind him he is out.

At Rounders matches, in order to prevent disputes, an umpire, whose decision on all points is to be final, should be appointed to ensure the due observance of all the rules of the game.

SEVENS.

This game consists in catching a ball seven times consecutively in some one particular way, and then again seven times in some other way, and so on. Among the different ways frequently adopted the following may be mentioned, but the ingenuity of the players will readily suggest other varieties. First catch the ball seven times with both hands, then throw the ball with the right hand and catch it with the same, then again catch it with the left hand, next throw with the left and catch with the left, and then throwing with the same hand catch the ball with the right; again throw, and clap the hands in front during the interval that elapses between the throw and the catch; vary this again by clapping the hands at the back; still another variety may be obtained by turning round between the throw and the catch, and so on until either a failure to catch the seven times consecutively is made or until ingenuity can suggest no further alternatives in the manner of throwing and catching than those already practised. The ball is then to be passed to a succeeding player. This is identical with the game known in some localities as "All Fives."

STOOL BALL AND STOOLS.

See "Doutee Stool."

STRIKE UP AND LAY DOWN.

In this game, which may be joined in by any number of players, one player only is "in" at a time, he being opposed by the remainder of the boys, who are scouting with the object of getting him out as soon as possible.

A circle at one end of the ground should be formed, in which the "in" player, provided with a ball and a round stick of the thickness of a broom handle and about eighteen inches long takes his place. His play is to throw up the ball, and while it is in the air to knock it with the stick as far away as he can, so long as it is not knocked out of bounds. If he hit the ball so that it is caught by any of the scouting players, he and the one who caught the ball change positions; if, however, the ball is not caught it is picked up by one or other of the scouts, the "in" player places the stick on the ground within the circle, and the scout who has picked up the ball then throws or bowls it towards the stick, endeavouring to hit it. If the aim succeeds the scout comes in and the striker of the ball takes up position as a scout. Should, however, the thrower of the ball fail in his aim, the game proceeds as at first. If any player fails three times in succession to strike the ball after it has been thrown by himself in the air he is out. To decide the next to come in, he has to drop the stick, and the different fielders run for it, the first to touch being entitled to the innings.

TRAP, BAT, AND BALL.

This game is very similar to the above game of Strike Up and Lay Down, except in the manner in which the ball is started.

The ball is placed in a trap (*see woodcut*), shaped somewhat like a shoe, which at the heel has been hollowed out like a cup; a handle fixed along the trap is balanced at the middle, and has a flat end which nearly covers the cup-like hole at the heel of the trap. The ball being placed on the flat end of the handle, depresses that end, and upon the other end of the handle being struck smartly with the bat the ball is sent up into the air, and should then be hit with the bat, and the game proceeded with as in Strike Up and Lay Down. The bat should be about fifteen inches long, the handle being six inches and the blade of the bat nine. The ball upon being fielded is to be thrown at the trap instead of the bat.



THE TRAP.

The game may be varied by the players, when numerous, being divided into sides, and when such is the case the "out" side only takes part in the fielding.

Points may be scored and counted towards game in the following manner:—When the batsman has hit the ball he should name the number of bats' lengths within which he considers it probable that the scout who has picked up the ball (or any one on the opposite side when sides are playing) will be able to throw the ball at the trap; if right in his challenge the number named are points scored; but if the scout throws the ball so as to hit the trap or so as to place the ball when at rest within the distance named, or indeed within one bat's length if no distance be named, measuring always from the front point of the trap, the player is to be out. A ball being thrown so as to pass to the rear of the trap without touching it counts as outside the distance named by the batsman.

Striking the ball with the bat so that it is caught by a scout, or failing to hit the ball with the bat in three successive tries, or striking a ball behind the trap, puts the batsman out.

In Hone's "Every Day Book" for 1831 it is stated that "a ball custom now prevails annually at Bury St. Edmunds, Suffolk. On Shrove Tuesday, Easter Monday, and the Whitsuntide Festivals twelve old women side off for a game at trap-and-ball, which is kept up with the greatest spirit and vigour until sunset. One old lady named Gill, upwards of sixty years of age, has been celebrated as the Mistress of the Sport for a number of years past; and it affords much of the good old humour to flow round, whilst the merry combatants dexterously hurl the giddy ball to and fro."

In evidence of the great antiquity of Ball Games, history or legend states of St. Cuthbert, who lived in the seventh century, that when eight years old, and as he played at ball with other children, there suddenly stood before them "a fayre yonge childe," who admonished Cuthbert against vain plays, and upon his taking no notice fell down and wept sore. Cuthbert and the children nevertheless still continued their game, and after a while the "fayre yonge childe" vanished away, upon which Cuthbert knew it was an angel, and from that time forth "lefte all such vayne playes."

The following extract is from Fosbroke's "Dictionary of Antiquities":—"Ball play was formerly played at Easter in churches, and statutes passed to regulate the size of the ball. The ceremony was as follows: The ball being received, the dean, or his representative, began an antiphone, or chant, suited to Easter Day; then taking the ball in his left hand, he commenced a dance to the tune, others of the clergy dancing round hand in hand. At intervals the ball was handed or tossed by the dean to each of the choristers, the organ playing according to the dance and sport. . . . It was the privilege of the lord or his locum tenens to throw the ball, and even the archbishop did it."

FIELD GAMES.

THE games described and mentioned under this heading may be thought to be very similar in character to those styled later on as Playground Games, but it has been thought well to make a distinction between the two, and it will generally be found that the distinction is borne out, and that the games here described are truly "field games," and require either the open country to practise them, or else a space of ground larger than generally is allotted to any ordinary school playground.

AUNT SALLY.

Is it possible that any boy able to play at Aunt Sally does not already fully understand all its mysteries? The wooden negress' head with the clean clay pipe stuck coquettishly in one side of the mouth must surely be a familiar sight to every one. Aunt Sallies by the scores and hundreds are ever travelling over the country for the enjoyment of all who care to be amused with their winsome ways. Yet somehow the game, to some good folk, smacks considerably of vulgarity. On the principle, however, that play of every sort in its proper place is good, and that no game or play is in itself vulgar, whatever the players may or may not be, our good old Aunt Sally is not to be excluded from this book.

The game is essentially one of skill in throwing. The conventional Aunt Sally consists of the wooden head and shoulders of a negress, painted, of course, black, with very red lips, the shoulders downwards clothed in bright garments. When a clean short clay pipe is stuck between her lips, she is ready for the onslaught of her foes. The players, provided with sticks of from fifteen

to twenty inches in length, and of the stoutness of a broom handle, station themselves in front of the figure at a distance varying according to the reputed skill of the thrower (generally from twelve to twenty yards). The players then alternately take a shy at the pipe, and he who is successful in shattering that article scores one. Every score made entitles the successful player to another throw. With skilful players a good supply of short pipes will probably be required, but substitutes for pipes may be easily discovered.

It is well that a net of some sort or other should be set up and spread out behind the figure, to save time and trouble in collecting the sticks for further use.

When an Aunt Sally figure is not readily obtainable an ordinary block of wood may be made to do service in her absence. The figure, or its substitute, forms a better object to aim at when raised from the ground on some sort of a pedestal.

BÂTON.

See "Knock 'em Down."

BOOMERANG.

The Boomerang, or Bommerang, should be classed among scientific toys, or, better perhaps, among the mysterious weapons of uncivilised tribes, for its vagaries are not at all understood, except by the savages, who make use of it as a weapon in war and the chase. Curious in its ways it most decidedly is.

It appears to be (*see woodcut*), and indeed it is, nothing more than a curved piece of wood, a little rounded on one side and flat on the other. Simple as this description of it may seem, yet, when held horizontally in the hand and cast swiftly away by bringing the hand well back and then forwards, it flies off in most extraordinary and unexpected directions, and will land itself, the thrower rarely can say where, but at his feet as likely as at any other place.



BOOMERANG.

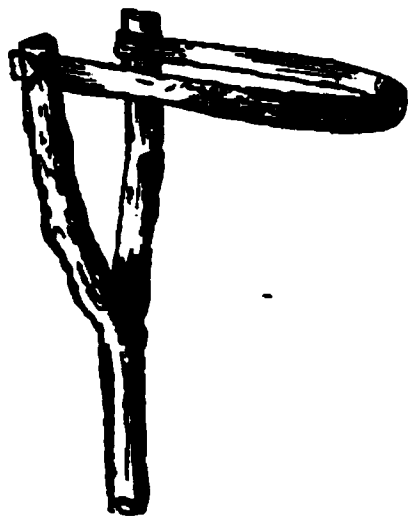
The weapon Boomerang, of which the toy is an adaptation, is used in war and in hunting by the natives of Australia, and by certain tribes of Central and South Africa, and they only really understand its peculiar turns and twists. A skilful native will throw a Boomerang so as to strike an object between which and the thrower, in a straight line, a big tree or a rock may be placed, and when the object aimed at cannot be seen, but its position only judged.

With practice some control over the toy may in time be obtained. To throw the instrument so as to bring it back towards the thrower, it should be held near one end, with the rounded side downwards; being then smartly thrown, it first ascends, repeatedly whirling round on its axis; it soon, however, commences its return movement, and finally by a descent falls fairly at the thrower's feet, or perhaps a little behind him.

CATAPULT.

The Catapult, like the Boomerang, was originally a weapon employed for attacking enemies or for killing game, by means of the propulsion of darts or arrows, but the toy catapult is mainly used for propelling stones or marbles. It is very simple, and may be easily made, a cleft stick, in the form of a letter Y, with a few inches of stout indiarubber, being the sole requirements. The stick, which should be about six inches in length, must have two prongs or clefts, each about three inches long, with a similar distance between the ends of the prongs, to which ends the indiarubber band should be firmly attached (*see woodcut*).

The stone or marble to be propelled should then be tightly held between the thumb and forefinger of the right hand and placed at the centre of the india-rubber band, but on that side of the band away from the palm of the hand. The handle of the instrument should then be firmly grasped in the left hand, the wooden part of the catapult being held perpendicularly. The holder should next stretch the indiarubber band as far back as possible, pulling it towards his right ear, and keeping it well at right angles with the stick, the ammunition being tightly pressed to the inside of the band. Now let him take a straight aim at the target or object to be hit, and when the weapon is at full tension suddenly let go the right hand, still keeping the catapult firmly held with the left. Skill in straight shooting may soon be acquired; but this is a dangerous toy to practise with in towns or streets, and we must warn boys against its wanton use, for they will certainly be held responsible for any mischief that may result from their thoughtlessly using the weapon in the neighbourhood of houses. In the country, however, a clever marksman will find many opportunities of displaying his skill without harming any one.



CATAPULT.

CLEFT STICK.

This is another of the toy-weapon school, but it is one to be made rather than to be bought. Cut a good ash stick out of the hedge, about two feet and a half long and slightly tapering, with a diameter of about three-quarters of an inch at the thin end and of an inch at the thick. In the thin end cut a slit well in the middle of the wood, about four inches long, then wind tightly round the stick, commencing at two inches and a half from the thin end and working one inch and a half down towards the thick end, a piece of strong cord or waxed string. A smooth pebble, flat rather than round, such as would be chosen for a long throw, is to be forced into the cleft so made in the stick. Holding the stick by the thick end, and suddenly jerking it, the stone will be made to fly out with some force and to a considerable distance. Practice with this weapon, as with the catapult, will soon secure accuracy of aim.

A pliant switch with clay balls, instead of the cleft stick and pebble, may be used with very similar results. The clay, rolled to the required size, should be placed on the thin end of the switch, and the switch held well back; upon the switch being then brought suddenly and smartly forward the clay will fly off in the same way as the stone flies out of the cleft in the stick. Boys must, however, be careful to employ this weapon in the open field, far from the busy haunts of men, women, and children.

CLIMBING TREES.

A good climber of trees bears some resemblance to a poet—the gift must be in-born; it may be improved upon, but it cannot readily be imparted. Watch a monkey, see how he climbs, and succeed like him if you can. Two or three hints may, however, be given to those anxious to try their skill. The tree to be climbed should be firmly grasped with the arms and open palms, the climber gradually lifting himself until he can also grasp the tree with his feet and knees, then gradually work upwards hand over hand, and as far as possible work the knees together; whenever possible, get assistance by placing the feet on ledges, knots, or rough places. For easy climbing select a tree with many branches, but unless the tree is in leaf be careful not to throw the whole weight on to any one branch, as dead and sere branches hold for a long time if not touched, but

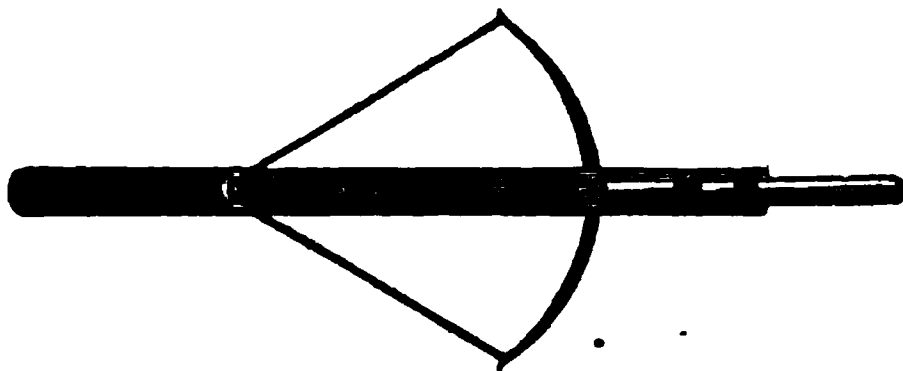
when weighted very slightly soon snap and give way. Above all things avoid that silly habit of "showing off" by attempting to climb into difficult positions. Hazardous efforts of this sort are really not clever, but excessively foolish.

COASTING.

Coasting, or slidging, as it is more familiarly called, is an exciting winter pastime. It can be enjoyed to perfection only in hilly districts, and during long and severe winters. The "coaster," or "slid," is made of all sizes, and very much in the manner of an ordinary sledge, except that the front part is more turned up to prevent the machine becoming embedded in the snow. The "slid" should be taken to the top of a hill or incline, the slopes of which are covered with frozen snow; passengers then take their seats, one of their number starting the machine by pushing behind and jumping in so soon as sufficient momentum has been obtained. The weight of the coaster and its load will keep it moving, and if the incline be steep the pace will be accordingly fast. The pace may be slackened or increased and the course guided by means of short poles thrust from time to time into the snow to the right or left, as necessity requires. For a venturesome boy a lid of a box or a similarly-shaped plank can soon be made into a rough and serviceable slid.

CROSS-BOW.

The Cross-Bow as a weapon has long been obsolete. In archery sports it is now rarely if ever seen, and seldom is it that even a boy cares to take his sport with so old-fashioned a toy. It is not easy to make a good cross-bow, and it is not cheap to buy one. An ingenious lad will, however, with a piece of stout wood, a piece of cane or whalebone, and some string, make a tolerable substitute for what is not worth the buying. A piece of wood thirty inches long, two inches wide, and half an inch thick should be obtained, and cut down to something of the shape of a gun-stock, a slight groove being scooped out of the thin side from the top, in which should be fastened, a short way down to the butt-end, a brass tube, through which the missile which is to be discharged from the bow must travel. A piece of cane or whalebone, from fifteen to eighteen inches in length, should then be thrust through a round hole bored through a piece of projecting wood at the back of the groove, within a few inches of the top of the stock, and a piece of cord or string, the length of the cane or whalebone, should be fastened thereto at both ends. The cross-bow is then made (*see woodcut*). With the left hand raise the cross-bow, and place the butt to the shoulder, pull the string down until the cane is well bent, place the shot against the string, in the groove before mentioned, take the necessary aim, and suddenly release the string. The rest need not be told. A trigger screw or button fastened to the side of the gun will be useful to attach the cord to when the bow is bent, and when an aim is taken the string may be released by pulling the trigger or turning the button and letting the bow fly up.



CROSS-BOW VIEWED FROM ABOVE.

DUCK AND DRAKE.

For this game flat stones, or better still broken tiles, or even oyster shells, and a large piece of water in the form of a lake, pond, river or the sea are required.

The player has to throw one of the first-named objects so that it may skim the surface or scud along the top of the water. To do this, the stone, tile, or shell to be thrown must be held flat between the thumb and forefinger, and must be thrown along rather than at or into the water. The first rebound after striking the surface of the water is termed a "dick," the second a "duck," and the third a "drake." A skilful player can, however, in a large sheet of water, secure more than three rebounds, a double "dick, duck, drake," not being at all unusual; indeed, eight, nine, and ten rebounds may frequently be made.

HOCKEY.

Hockey is an excellent sport, which is apt to be underrated by those who have not seen it properly played. It is a game, however, which is gradually being revived, and deservedly so, for it is a really healthy and exciting pastime. In many respects it bears a strong resemblance to Association Football, both in its principles and the disposition of the players, with this advantage (which boys, perhaps, will not think much of), that it lacks a good deal of the roughness of Football, and presents hardly any risk of serious accident.

A Hockey Association has been formed, the rules of which have been adopted by most of the principal hockey clubs, and it will be advisable for clubs to play strictly according to these rules;* else it will be difficult to arrange matches.

The game is played with eleven players a side, unless otherwise agreed upon by the respective captains, who, in the absence of an umpire, shall decide all disputes or questions that may arise.

The hockey-stick is usually made of ash, with a hook or curve at the bottom. It must have no metal fittings whatever, and be able to pass through a ring two and a half inches in diameter. For matches, the ball used is an ordinary cricket ball painted white; but for practice, on the ground of expense, boys will probably prefer to use an indiarubber one. No player is allowed to wear boots with projecting nails or metal spikes.

The ground should be one hundred yards long and fifty yards wide. The longer sides are called the *Side Lines*, and the shorter sides the *Goal Lines*. It is marked out, as at Football, with flags at each corner, and at equal distances of twenty-five yards along the side lines, and it is well to connect these by a line drawn all round the ground to mark the exact boundary. The goals are placed in the centre of each goal line, and consist of two uprights twelve feet apart, joined at a height of seven feet from the ground by a horizontal bar or tape. In front of each goal, at a distance of fifteen yards from it, a line twelve feet long is drawn parallel with the goal line. The ends of this line are curved round to the goal lines by quarter circles, of which the goal posts form the centres. The space thus formed is called the *Striking Circle*, and no goal can be scored unless the ball be driven between the goal posts, and under the bar or tape, from a point within the circle.

The choice of goals is tossed for at the beginning of the game, and ends are changed at half time. The game is started from the centre of the ground by one player on either side *bullying* the ball. The *bully* is played as follows:—Each player strikes the ground on his own side of the ball, and his opponent's stick over the ball, three times alternately; after which either of the two players is at liberty to hit at the ball. In all cases of a *bully*, every player must be between the ball and his own goal line.

The game once started, the ball must be played from right to left only, and no left- or back-handed play, charging, kicking, collaring, shinning, or tripping is allowed; and in striking the ball no player must raise his hockey-stick above his

* Obtainable at the office of *The Field*, Bream's Buildings, Chancery Lane, London.

shoulder. The rules of "off-side" are the same as at Football, and the player thus situated is out of play until the ball has been hit by another player. Any breach of these rules committed outside the striking circles gives a *free hit* to one of the opposite side from the spot where the rule was broken. During such a free hit the players on the offending side must fall back five yards from the spot whence such a hit is made, and the striker is not allowed to play the ball again until it has been hit by another player. If the breach of rules takes place within the striking circle, and the attacking party be the offenders, the defending side can claim a free hit; but if the defenders be in fault, then the attacking side are allowed a bully.

The ball can be caught, or stopped with any part of the body; but must not be carried, kicked, or moved on, except with the hockey-stick.

In the event of the ball being hit over the side lines or into *touch* (to use a football expression), one of the opposite side to the player who last hit it shall roll it out along the ground at right angles to the side line from the point where it crossed. The ball may be rolled out at once, and whilst so doing, no other player can stand within five yards of the side line. If the ball is hit behind the goal line by the attacking side it is to be brought out twenty-five yards in a straight line, and there bullied; but should the ball glance off, or be hit behind by any of the defending side, then one of the attacking side shall hit it out from the nearest corner flag, and at the moment the ball is so *hit out* all the defending side must be behind their goal line, and the remainder of the attacking side outside the striking circle.

Having thus briefly summed up the principal rules of the game, it remains for us to add that tactics similar to those pursued in Association Football are those most likely to ensure success at hockey—*dribbling*, or a gentle trundling hit, keeping the ball well in hand and dodging, rather than a succession of slogs; when hard pressed by the opposing side *passing* to another player on one's own side, and generally by judicious manœuvring aiming at victory by skill and management rather than by force. It is essential that all the members of a team work well together, back up, and pass unselfishly; in fact, play for their own side to win rather than to display their own individual prowess.

The players are usually arranged as follows:—three centre; two left wing; two right wing; two half back; one back, and goal-keeper, who should be a safe catch and good field, so as to stop any shots at goal. This arrangement of the men may of course be altered to suit circumstances, or the disposition of the opposing team.

HOCKEY ON THE ICE.

See "Skating," pages 77 and 78.

HOUNDS AND HARE.

See "Paper Hunt."

JAVELIN.

The weapons employed in this game are rods of ash or fir, varying from four to six feet in length, tapering from an inch and a half in diameter at the thick end to about an inch at the thin end, which should be tipped with an iron spike about two inches long. These spikes, if made to order at the forge of a local blacksmith, and fitted by him on to the rods, will be more serviceable, and probably cheaper, than if purchased in the usual way. A target, at which to throw the javelin, will be required, and it may be improvised out of any convenient material, and marked to suit the fancy of the players; it should be, however, of some soft material, so that a well-thrown javelin will, when striking it, become embedded at the tip.

To throw the javelin, it should be balanced in the hollow of the hand from

which it is to be thrown, usually, of course, the right, and held a little above the level of the shoulder; the shaft of the weapon is then to be firmly grasped with the fingers, the thumb being extended along the fingers; the left leg is to be advanced and the body balanced on the right leg. After the aim has then been carefully taken the javelin should be hurled towards the object to be hit, and to secure the requisite momentum it will be necessary, when in the act of casting the javelin, to bring the body quickly forward from the right on to the left leg. Left-handed throwers will understand that they must balance themselves on the left leg, advancing when throwing on to the right.

KNOCK 'EM DOWN.

This is a game in many respects similar to that of "Aunt Sally," and is more practised at fairs and in public recreation grounds than privately among friends.

Short poles, or even old bayonets (to such "base uses!"), about two feet and a half to three feet high are placed in holes of a foot in diameter, dug out to a depth of not more than five or six inches. Some article should be balanced on the top of the pole, such as an orange, cocoa-nut, or even a stone; and the game then is to stand at a distance of from twenty to twenty-five paces, and to throw a stick or cudgel to hit the object so balanced off the pole in such a manner that it falls outside and not into the hole. To accomplish this it will be necessary to hit the article on the top of the pole, for if the pole merely be hit, the object will simply drop off into the hole.

At fairs, and such like places, cocoa-nuts are usually placed on the top of the poles; the player purchases from the proprietor the right to a certain number of throws, and takes all the cocoa-nuts he can knock off the poles and outside the holes. Instead of digging holes in the ground, the poles are frequently placed in baskets of sand, and so supported perpendicularly.

This game is known as *Bâton and Pitch Club* as well as *Knock 'em Down*.

PAPER HUNT.

This game is more generally known as "Hare and Hounds," but the name of Paper Hunt is equally descriptive of the game as it is really played. Clubs, calling themselves Harriers are established in the neighbourhood of most large towns, and are recognised as Athletic Clubs, and as such permitted to enter for the sports of Athletic Club Meetings. Regarded in its athletic aspect, something has already been said about this game in the section devoted to Athletic Sports (p. 114). Members of cricket clubs who do not, during the winter months, indulge in the game of football often convert themselves into Harriers, and indulge in Paper Hunts. Any number of players can form themselves into a team, and each time a run is decided upon one of the players is selected to play the part of the hare. It is not well, for the sake of the hounds, that the hare should be the fleetest of foot, but should be selected mainly for his staying powers and for his knowledge of the surrounding country, in order that the pains and penalties visited upon trespassers may be avoided by hare and hounds alike, and also that by such knowledge he may the more readily throw the hounds off the scent. "Law," being a certain number of minutes' start (usually ten), is to be given to the hare, who, provided with a bag full of cut paper (technically called "scent") runs off, occasionally scattering scent as he proceeds. When law is up or has expired, the remainder of the team, known as the hounds, proceed in chase, running Indian file at distances from each other of from three to seven yards, taking their clue as to the route from the scattered scent. The hounds should be led by the quickest runner of the party, and he is generally known as the Master of the Harriers. The Whipper-in, who brings up the rear, carries a small

flag, and should be a lad of tact and management, able to cheer up the weak ones and control the refractory. The master carries a horn, and runs on as well as he can from scent to scent, being careful to deviate as little as possible from the track. If he loses scent, he announces the fact to the pack by blowing three blasts on the horn. The pack immediately halts, Whipper-in plants his flag at the last scent, and the hounds circle round the flag, each from his halting place. Scent is thus soon recovered, the master is informed, and with another sound of the horn all are at once in file, the flag is again waved aloft by the man in the rear, and all proceed again with their "Yoicks" and their "Tally-hoes" resounding merrily. So on, for the whole run, the game continues until either the hare is run to ground and caught, or until his pursuers, baffled and pumped out, exhausted, give up the chase for the day, allowing the hare all the glories of being hunted again on the next outing.

But few laws are required to govern the game. It is well if the hare be prohibited from making tracks for home until he has been out two hours, although he should not by any means be bound to pursue a straight course. Retracing steps or crossing scent is prohibited, unless permitted by arrangement before the start. As for the hounds, their only law is to run the hare to ground, that is, to catch him.

Sometimes, and in certain localities, it is the practice to start several hares, each one carrying a bag of paper. The scent may in this way be placed so as to mislead the hounds to a more considerable extent, but its tendency is to split up the pack and to prevent it from acting together as a unit, for if scent be placed in different directions by different hares it has all to be followed up until it is discovered which is the true scent and which the false. This scattering of scent entails a loss of time and energy both to the hares and the hounds, and the runs obtainable under this version of the game are very inferior to those when only one hare starts. When the hares starting are more than one, the different bags containing the scent are, when emptied, hidden by the hares, and the hounds have to find the bags rather than merely run down the hares.

Some authorities give it that the hounds must make no short cuts, but are bound strictly to follow the scent; this is a law difficult to enforce, and is hardly fair to the pack, for although all help in finding a lost scent, yet otherwise, the pack, as a whole, is no stronger, in the matter of fleetness, than its weakest or slowest member.

The game needs practice before it is wise to attempt very long runs; trained harriers, however, after a season's work, look upon a run of anything less than twenty miles as rather a poor affair. They, like the genuine Fox-hunter they hope some day to become, enjoy a right good burst across country, and then take the train home.

PITCH CLUB.

See "Knock 'em Down."

SHINTY.

In the Highlands of Scotland, one of the most popular games, if indeed it is not the prime favourite, is that known as Shinty. Speaking generally, it may be described as corresponding to the English game of Hockey, though it ought to be played on a much larger piece of ground, and if possible with clubs specially made for the purpose. Shinty is governed by a strict code of laws. Like Golf, though not to the same extent, the game is making inroads into English territory, and the London Scots Shinty Club—whose Hon. Secretary (30, Caulfield Road, Peckham, S.E.) will no doubt be glad to give every information as to the game to inquirers residing in the Metropolitan district—plays near the Windmill on Wimbledon Common. It may be added that, in

spite of its suggestive name, the word has nothing to do with the human shins, but is derived from the Gaelic word *sinteag*, meaning a "skip" or "bound."

SLIDGING.

See "Coasting."

SLING.

As the breechloader has superseded the muzzle-loading rifle, so, some centuries back, did the crossbow supersede the sling as a military weapon. The art of slinging is among the most ancient of offensive military operations. Its use among the ancient Jewish nation is well authenticated in their Scriptures, and it is well known to have been still used in warfare during the early part of the fifteenth century.

The construction of the modern boy's sling is very simple. A piece of leather should be cut into an oval shape, being not more than two inches in width at its broadest part, and five inches long. A piece of string should be fastened to each end of the leather, and at the end of one of the pieces of string a loop should be made; the string with the loop being about twenty-seven inches in length, the other about twenty-four inches. In use, a stone, pebble, or bullet is to be placed in the centre of the leather, the loop of the one string placed round the little finger, and the end of the other string being held between the forefinger and the thumb. Upon the sling being then whirled swiftly round the head, and the shorter string suddenly released, the stone will be sent to a considerable distance with very remarkable force and speed.

Although accuracy of aim may be ensured by frequent practice in this way, it is yet very dangerous for a novice to try his hand at it except he is very cautious in his first endeavours. The sling, like the catapult, and other toys of a similar nature, should be used only in the open country, and not brought into the streets or playgrounds.

SLING THE MONKEY.

This is a game affording capital fun for all those whose lot it may be not to play the part of the monkey. Lots are to be drawn for the first monkey. The monkey should then be suspended by the waist to one of the lower branches of a tree, so as just to be able to touch the ground with his toes. The players then being armed with that favourite schoolboy weapon, a knotted pocket-handkerchief, and the monkey with a piece of chalk, it is the business of the player to whack the monkey, and of the monkey to chalk-mark one or other of his tormentors. The tormentor who first receives a chalk-mark takes Monkey's place. Any player hitting the monkey for the time being on the head or above the shoulders has also to be punished by being made to take Monkey's place.

STEEPLE CHASE.

Some good cross-country running may be arranged in playing at this game. A lot of lads meeting in an open country fix on some conspicuous object in the landscape—a big tree, a plantation, a church, a house, or what not—and each endeavours to be first at the object fixed upon. Hedges, ditches, and even rivers may intervene, but it is the duty of every one to make the best of his way to the place of rendezvous. The first there wins.

TOBOGGANING.

See "Coasting."

HOOP GAMES.

BEFORE attempting any of the Hoop Games it is well to understand how to trundle or bowl a hoop. Hoops are made of two materials—wood or iron. Wooden hoops are trundled by being knocked with a stick; iron hoops may be propelled in the same manner, but the more approved fashion is to use a hook. The hook is an iron rod about six or eight inches long, curved at one end, and fitted with a wooden handle. Wooden hoops are toys generally allotted to girls, while iron hoops are usually affected by boys. Hoop trundling is a pastime not much indulged in by lads above twelve years of age, but many are the grown men who lingeringly look back to their trundling years, and would fain again arm themselves with the familiar hook, and send the hoop spinning along, as they did in times long gone past. There is genuine and healthy excitement to be had from a good hoop race, success in which demands nimbleness of foot, lightness of touch, and dexterity in management. To trundle a hoop with the aid of a stick requires but little instruction or practice, but the use of the hook is not so simple. When using the stick judicious guiding touches are required to the right and the left of the hoop from time to time to keep it in a straight course; but with the hook the hoop may be guided in any direction without any apparent change of manipulation. The hoop should be started by a gentle stroke from the straight part of the hook; the hook should then be pressed on to the hoop rather more than half-way down to the ground, the pressure being applied more or less gently, according to the speed required. It will be then found that without removing the hook the hoop will be kept trundling at any desired pace, and may by the slightest possible turns or twists of the wrist be guided into any desired direction; the sharpest of corners or the smallest of circles may be made without any risk of overturning the hoop, and such feats may be performed by means of the hook as could never be attained by the stick. Ingenuity will devise many descriptions of hoop games, but a brief description of a few, which will form the basis of others, is here given.

ENCOUNTERS.

This game is played by two boys starting from the opposite ends of the playground, and when meeting each other endeavouring each one to drive his hoop in such a direction as to knock over that of his opponent. This is not by any means an easy thing to do, and the ground will frequently be traversed several times before success falls to either player; practice only will impart the skill that will enable the player to strike his opponent's hoop in just that part where it will prove most effectual, and practice will enable a careful player to give just such a knock to his hoop when struck as will ensure a recovery.

HOOP RACE.

In this game there may be any number of players. The signal to start being given, off race the players, he who first arrives at the goal with his hoop trundling being the winner. The larger hoops will, of course, cover the ground faster than the smaller ones, and the principle of handicapping, that is, giving starts to the boys with the smaller hoops, should be allowed.

POSTING.

To play this game a circular ground should be marked out, with stations at equal distances, and in number to equal the players. In commencing the game the players arrange themselves one at each station. He at station No. 1 trundles

his hoop on to station No. 2, the player at that station taking the hoop on to station No. 3, and so on; the player at the last station taking the hoop on to the first. Any one touching the hoop with his hand, or allowing it to fall to the ground, is out, and his station for the time should be abolished. The player keeping in to the last and trundling the hoop round to all the stations wins. One, two, or more hoops may be used in playing at this game.

RETURNS.

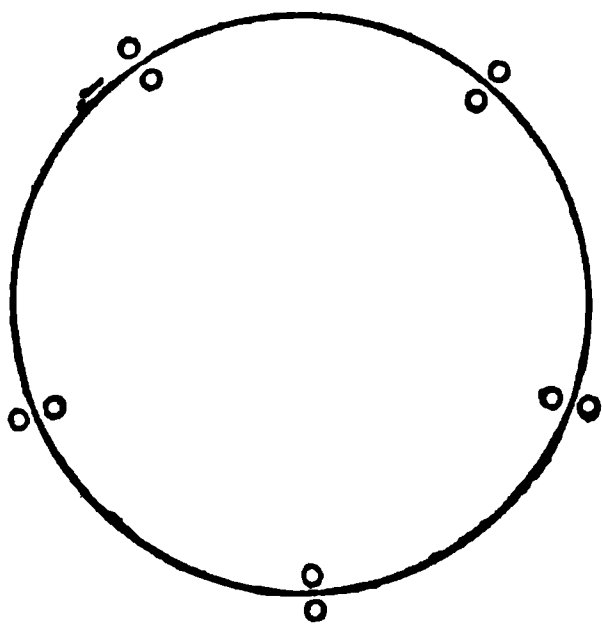
An ingenious game played with the hoop alone, called Returns, is that of throwing the hoop in such a manner and with such a twist that after proceeding some distance it will return to the thrower. This is done by making the hoop twist round in the opposite direction to that in which it is thrown. So soon as the hoop touches the ground it will come tumbling back to the place from whence it was started.

STEEPLE CHASE.

Steeple Chase is a variety of the game of Hoop Race, but requires large and heavy hoops. Some object across country (which, however, must not be very stiff), is to be fixed upon as the winning-post, and most players make the best of their way there without touching the hoops with their hands. As in the game of Steeple Chase, described under the heading of Field Games, a knowledge of the country to be gone over is very requisite. For every time the hoop is touched with the hand the player should count as being put back a certain length of time—minutes or seconds, as may be decided upon according to the course to be travelled.

TOURNAMENTS.

This is a capital amusement, and may be shortly described as Encounters on a large scale. Any even number of players may take part in the game. They divide themselves into sides, and each member of the respective sides endeavours so to knock his hoop against the hoop of some one of his antagonists as to overturn it. This game affords much fun, as sometimes a dead set may be made against some individual hoop, ending, not in the overthrow of the intended hoop, but in a collision and general fall of the hoops of several of those who had agreed to make the concerted attack.



PLAN OF TURNPIKE GATES.

TURNPIKE GATES.

One hoop only is required in this game. A circle, as shown in the diagram, is to be made; which should be not less than from forty to fifty yards in circumference. Turnpikes numbering one less than there are players are then to be marked out by placing two bricks at each turnpike, one on each side of the circle, and about four inches apart. All the players but one, who should be selected in some manner agreeable to all, have then to take charge of the turnpikes, a player being stationed at each

“pike.” The remaining player then takes the hoop and trundles it along the circle and through each turnpike in succession. Should the hoop in its transit touch any one of the turnpikes, the trundler takes the place of that turnpike-keeper, the latter taking the hoop. If the hoop is allowed to fall, or is at any

time touched with the hands, it is to be handed over to the nearest turnpike-keeper. It is well that a minimum speed at which the hoop is to be trundled should be fixed upon, in order that the changes of turnpike-keepers may be tolerably frequent.

Instead of playing the game of Turnpike in a circle, it may be played, if wished, by marking the turnpikes along a straight line; but the chances of changes in the keepers are thereby much lessened, as the hoop-trundler may in this way make a considerable diversion in his own favour every time he comes to either end of the line.

Nearly all of these games may be played by giving to each player two hoops instead of one to take charge of; more diversion is then obtained, but it will generally be found advisable under such circumstances to discard the hoop for the more old-fashioned stick.

KITE-FLYING.

ABOUT MAKING CALICO AND PAPER KITES.

"A KITE is a paper toy for flying in the air, and is so called from its flying like the bird called a kite," which in turn is described as "a hovering bird." These two definitions will perhaps best convey to the reader the nature of the toy to be described under the heading of Kite-flying.

The kite may be made of either paper or calico, although the former is lighter and makes the better flying kite, while the latter is the more durable. The paper kite is the most to be recommended, especially if every lad, having ambition in the matter of kite-flying, makes his own, and this he should always endeavour to do, as patience and care are the two most needed servants in the manufacture, and, when duly applied to the materials at hand, will result in a very satisfactory toy. Moreover, paper kites being easily damaged and destroyed, and somewhat expensive to purchase, the pleasure derived from making a good kite should be quite equal to that of flying the kite when made. It may also be here noted that the better made the kite is, the more perfect and symmetrical in all its parts, the greater will be the success and satisfaction in flying it. Just as the flying of the kite and watching its graceful motions in the air, during a long hot summer's day, form an interesting pastime, so will it be found that the making of the kite will afford an agreeable and pleasant occupation during the long and dark winter evenings.

A few remarks on the making of kites will therefore not be here out of place. First of all, then, let it be noted that the size of the kite is quite immaterial. The kite may be so small that half a sheet of tissue paper will suffice for its covering, and that a small ball of cotton thread is all that will be needed to fly it; or it may be of monster size, ten feet or more in height. If made, however, of such huge proportions it will be found best to use calico for a covering; and a strong line to fly it with, or rather to keep it from flying away, should be attached to it.

Having decided upon the size, the skeleton is to be prepared in the following manner (see Fig. 1). A straight, strong, but light, lath should be obtained, of the required length, to form the backbone of the kite; it should be shaped to a point at the top. A small piece should be notched out of the lath a short way from the top on each side, and also on each side a little way from the bottom. The former notches are to hold the string which fastens on the bow, the latter are to catch the strings over which the paper or calico is to be pasted. A notch is also to be cut

at the point marked H in the figure. The backbone is also known and may be described as the "standard," "straighter," or "upright," and is marked in the diagram A B. The "bow" or "bender," marked C D, should be of a piece of

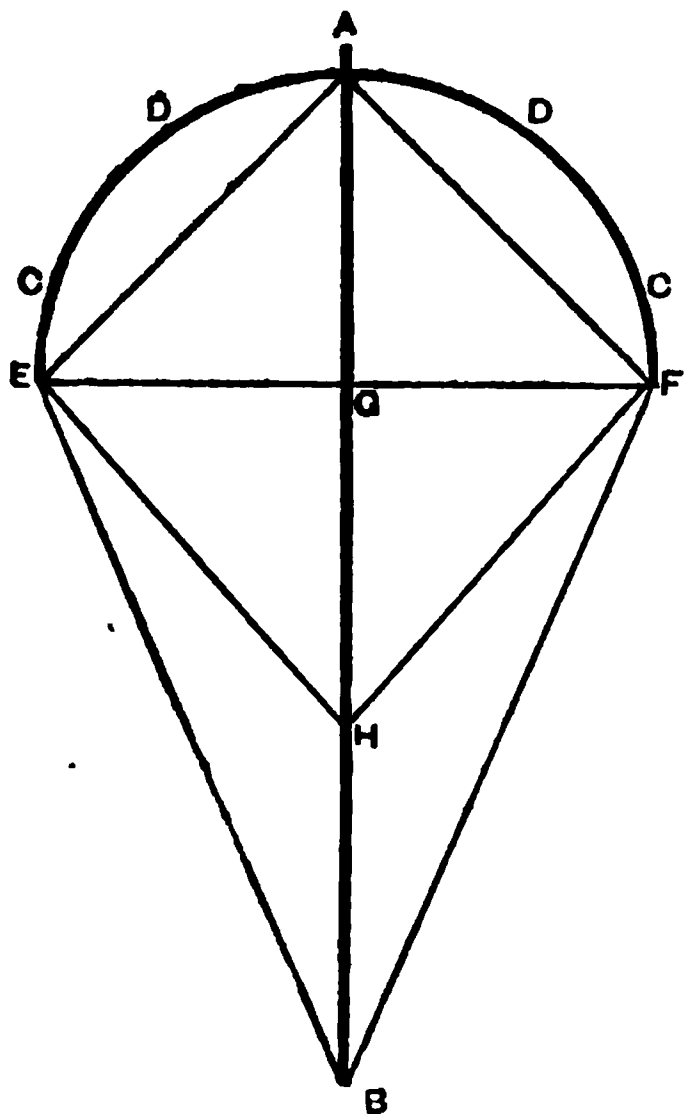


Fig. 1.—SKELETON OF KITE.

pliant wood, such as may be obtained from the ash or hazel, should a piece of cane not be readily procurable. A piece of a wooden hoop, thinned down to the thickness of a common cane, will be found useful out of which to form the bow. Whatever it be, it is essential that it be of equal thickness and weight throughout its whole extent, and that its length be about the same as that of the backbone. The exact centre of the bow should next be ascertained, and fastened with thin string to that point of the backbone where the first two notches were cut. A small notch is then to be cut at each end of the bow, and the bow bent down to the points marked E and F. In the diagram the thick lines represent the bow and the backbone of the kite, which are made of wood, as above described; the thin lines represent string, and should be secured to the wooden frame as follows:—Secure the end of the string at the point E, pass it on then in succession to the points B, F, E, A, F, H, and E, fastening the string at each point, and upon passing the string from F to E twist it once round the backbone at the point G. The skeleton is then complete; but if the balance is not quite

true, shavings from the heavier side should be sufficient to remedy the defect.

The point next to be decided is the covering. All things considered, paper is best for an all-round kite; paper kites truly are very easily damaged, but then the damage is as easily repaired, and paper is inexpensive and always to hand, old newspapers serving the purpose as well as any other kind of paper. For the largest kites, calico, silk, or thin gutta-percha cloth may be preferable, but even for these very stout paper—for example, sheets of the *Times* newspaper—will be found to answer every purpose. It is to be remembered that small kites require to be made of thinner and lighter material than larger ones.

Having agreed to use paper as the covering, it should be cut of the shape of the kite, leaving a margin just sufficient to overlap the bow and the strings, so as to curl round; the edges of the paper should then be fastened to the frame of the skeleton by means of gum or paste, and left to dry. The covering is to be secured to the back-bone of the kite by pasting some slips of paper across the back of the kite. If the kite is large it is also well to secure the covering to the cross strings in the same manner. Should it be found that one sheet of paper is of insufficient size, two or more sheets may be pasted together, the edges of which should overlap about an inch. Calico, or materials of that nature, may be sewn on the strings and bow instead of being pasted on, and should in that way also be secured at the back to the cross strings and the back-bone. Before securing the covering to the back-bone two holes should be pierced therein, the one at the fifth of the whole length from the top, the other at a trifle less than the same distance from the bottom. Through these holes a string is to be passed

and fastened at the back of the kite; this string is known as the "belly-band," and to it is fastened the string by which the kite is flown.

The kite proper is now complete; but as the kite cannot fly without a tail, the construction of that appendage is next to be proceeded with. Ordinarily, the tail is a long string with pieces of folded paper fastened on to it at regular intervals. Its length depends on the size of the kite and the weight of the string and paper out of which the tail is made, together with a number of other considerations, all of which experience will soon point out. It should, however, never be less than twelve times the length of the kite, and the longer it is the better, so long as the kite is big enough to carry it. The tail papers should be tied on by noose knots, and at intervals of from three to four inches. A paper tassel tied to the end of the tail forms a graceful finish. The tail is then complete and ready to be fastened to the bottom of the kite; for convenience of carrying it is better to keep it rolled up, and to fasten it on only when the kite is in the field from which it is to be flown. The use of the tail is to steady the kite and to keep the kite's head to the wind. If the kite seems to rise with difficulty the tail has probably been made too heavy; should the kite dip and plunge, or show a tendency to topple over, the tail is probably too light, and may be weighted with any convenient object, a stone or piece of turf being generally found handy and serviceable.

Wings or tassels attached to the ends of the bow add to the graceful appearance of the kite, but will usually be found to diminish its flying powers. Experience will in this matter, as indeed in all others, soon teach when tassels may be judiciously affixed and when removed; the state of the wind having very much to do with all these questions of additions to and ornamentations of kites.

Upon the preceding instructions being carried out, a useful kite of the common pattern will have been made, and although the pattern and form of the kite may be much varied, it being sometimes made of very fantastic shapes, the above will be found to be the best kite for flying. Some of these fantastic shapes will be mentioned farther on; but first a few words of

ADVICE ABOUT FLYING

had better be given. As to the day on which to fly the kite, it is unnecessary to say that a calm day is of no use, and a stormy day with a gale blowing is not much better; a nice bright day, with a steady even breeze, should be fixed upon for choice. The end of a ball of string should then be tied on to the belly-band of the kite, in just that place most suited to the capabilities of the kite, and which will vary with every kite. To raise the kite, assistance from a friend will be required. The friend should hold the kite upwards by the lower end as far from the ground as he can. Sufficient length of string being unwound from the ball, he who is about to fly the kite should, string in hand, face towards the wind, and having given the signal to let the kite go, start off at a run. The kite being properly made, if the breeze is suitable the kite will soon rise, and the run need be neither very far nor very fast, for a good kite will soon find its balance, and float quite steadily in the air, slowly rising upwards as more string is gradually unwound. The string should, however, be let out only gradually, and in such a way as to keep, as it were, a gentle hold on the kite. When the kite pulls let it have a little liberty, but as a good driver always feels his horse's mouth on the reins, so should the kite flyer always feel the kite on the string, and string should not be paid out except when it is called for. A kite will not rise to an unlimited height; but by fastening one kite to the back of another, and starting the second kite as the first was started, and so on, two, three, or more kites may, with a

favourable wind, be sent to a very great height. To bring the kite down is an easy matter. The string that has been paid out is to be slowly wound up, so as to bring the kite down gradually, any sudden jerk being avoided; the kite may thus, by careful treatment, be taken safely home, and be fit to fly again some other day.

Large kites are sometimes effectively coloured and marked with various patterns, according to taste; but, as a general rule, all ornamentation whatever should be done in the boldest possible style. Brilliant colours and decided lines alone are to be employed, or the decorative work will be entirely lost to sight. The colouring may be painted on the kite, but any addition of this sort is most effectual when the figures to be portrayed are cut out of coloured tissue paper and pasted on the body of the kite.

Although a kite flies best when made after the model described above, it may be much varied and made in such a way as to represent different objects or figures. An ingenious maker will soon discover forms and figures that will suit his own fancy; but, among others, the Bird, Dog, Fish, and Sailor Kites may be more fully described, and it will, indeed, be found that almost any oblong figure can be made in such a way as to fly more or less successfully.

BIRD KITE.

This should be made to represent a bird, say a hawk, with its wings outspread. It makes a very pretty toy, and when high in the air forms a pleasing and natural-looking object.

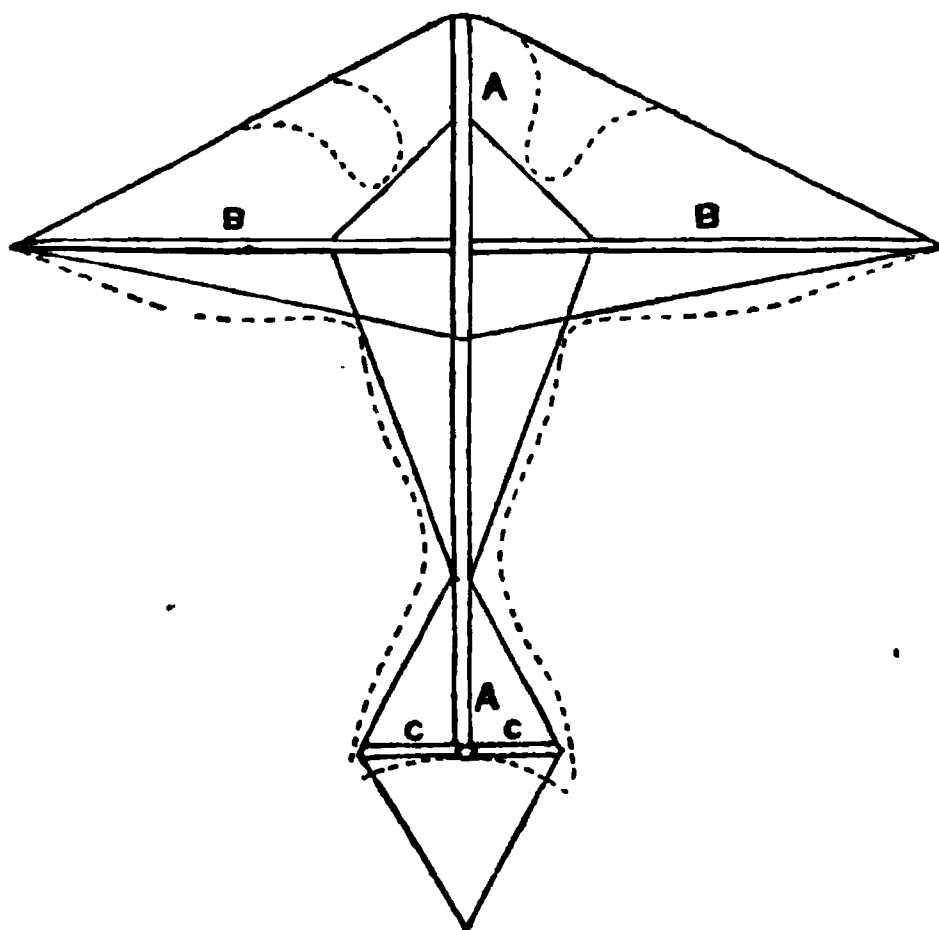


Fig. 2.—SKELETON OF BIRD KITE.

The skeleton (Fig. 2) consists of an upright (A A), with a large cross-piece (B B) fixed at about a third of the length of the upright from the top, and a smaller cross-piece (C C) fitted at the bottom of the upright. The head and beak should be of bonnet wire or split cane, and secured in a notch at the top of the upright. The string should then be placed as shown in the thin lines in the accompanying figure, and the skeleton of the Bird Kite will then be complete. The skeleton is then to be covered as explained in the preceding description, the covering being cut out as nearly as possible in the manner shown by the dotted lines. It will be understood that the double lines

in the figure are intended to represent the upright and the two cross-pieces. The larger cross-piece may be jointed at an inch or two from the point where it is attached to the upright, and in flying, if strings are attached to the points of the wings they may be made to flap in the air, and by a little management, hawk-like swoops and pounces may be very fairly imitated. Fig. 3 shows the bird kite in its completed state.

The foregoing description of the Bird Kite must be taken as an example only of the form out of which kites to represent birds may be made. A favourite specimen, representing a large bat, may frequently be seen on commons and parks, during the early summer months, which may be taken as the time of year during which kite-flying is fashionable.

DOG KITE.

This kite is made in a similar manner to the preceding one, but in order to obtain the requisite shape, it is to be made in imitation of a dog sitting on its haunches, or standing on its hind legs. The top cross-piece, however, of this kite must be much smaller in proportion than that shown in the figure explaining the instructions as to making the Bird Kite.

FISH KITE.

For kites of the fish shape, again, a backbone and two cross-pieces are required, the larger being placed well up towards the top of the kite and at the back of the fins, the shorter cross-piece being made to serve as the framework for the tail. As in the previous shapes the outlines must be secured on string stretched as nearly as possible at the outside edge of the toy.

SAILOR KITE.

Sailors lounging about the docks and landing stages are usually seen with their hands in their breeches' pocket, a heavy pea-jacket for a coat, and a son'-wester hat. Take the sailor so attired as your model; prepare the skeleton of the kite as for the Dog Kite and Fish Kite, fixing a bit of bent wire round from the top cross-piece so as to form a firm outline for the hat. The covering may then be fastened on, and a little skilful manipulation will soon end in turning out a fairly accurate representation of an honest Jack Tar ashore.

Before dismissing the subject of kites from notice, there remains to say a little on the subject of

MESSENGERS.

In flying a kite, and when all the string is paid out, or when the kite shows no tendency to fly any higher, the fun, with the exception of hauling down, would be over, were it not for the messengers, and by the aid of these clever little people the amusement may be prolonged considerably.

Messengers may be made in various ways; ordinarily they are small pieces of paper or pasteboard three or four inches square with a hole in the centre. The end of the string held in the hand, and which is the extreme end of that attached to the kite, is to be passed through the hole in the messenger, which

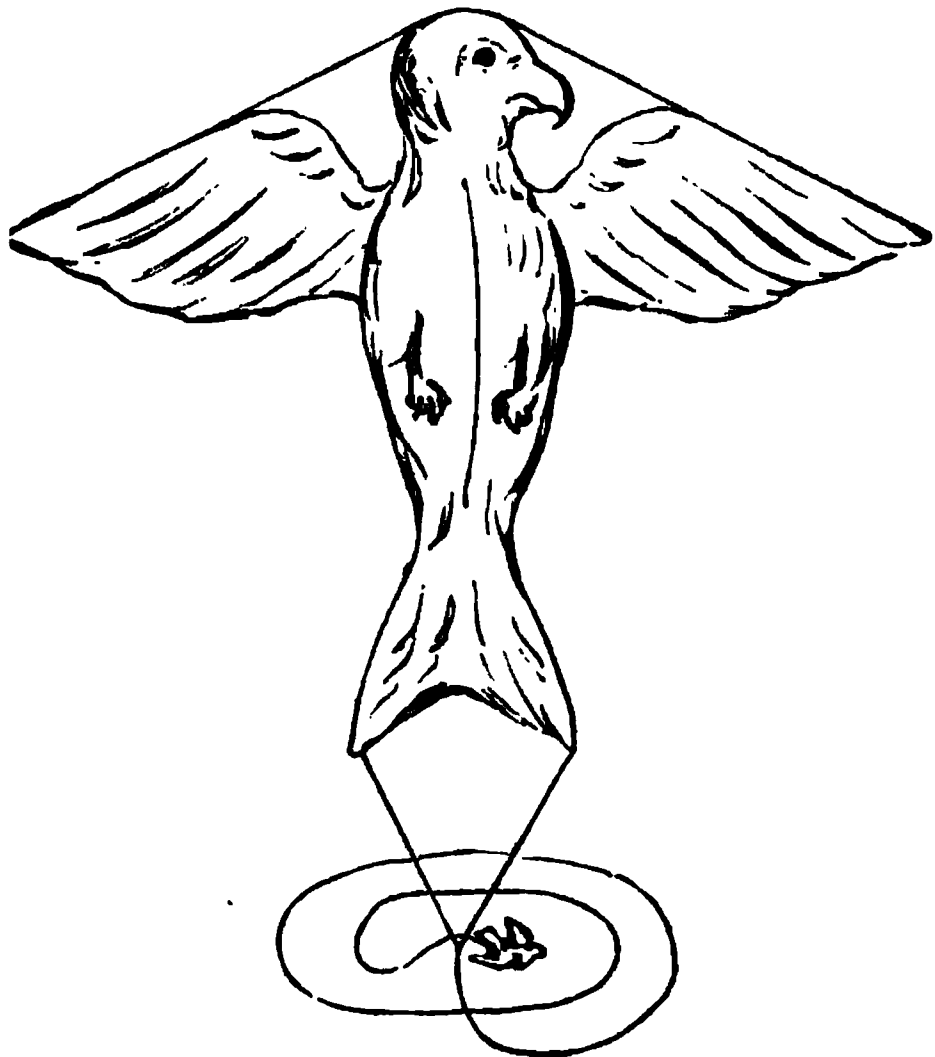


Fig. 3.—BIRD KITE READY FOR USE

will then be swiftly borne along the string by the wind right up to the kite flying so peacefully high in the air. These messengers may be sent from time to time, but the number must be limited, or they will prove too heavy for the kite, and drag it prematurely down. A more complicated form of messenger consists of a hollow cylinder of thin wood, the diameter of which is sufficient to allow of its free revolution round the string; to the cylinder are attached in an oblique direction several flappers, or sails made of paper. The action of the wind on these flappers will cause the cylinder to revolve, and will carry the messenger upwards to its destination.

As a final hint to kite-players, it should be said that a clear open space, as free as possible of trees, houses, or hedges, should be chosen, for the kite in its descent is apt to be somewhat erratic in its course, and if caught on any of the objects named, it is likely to be so seriously damaged as to be of no further service without spending much time and care on its renovation.

MARBLE GAMES.

ABOUT SHOOTING THE MARBLE.

ALL boys careful to do well that which is done at all should, before entering into any contested marble games, be quite satisfied that they thoroughly understand how to shoot a marble in the truly scientific and orthodox manner. There is only one way to shoot a marble properly. There may be plenty of ways never yet recorded as to the manner in which a marble may be projected from the hand unscientifically, but among the unscientific modes that have



HOW TO SHOOT THE
MARBLE.

been recorded, and all of which should be unhesitatingly discarded in the higher marble games, are the following:—Marbles are sometimes irregularly bowled, or thrown, or shot, by placing the marble in the bent joint of the forefinger, and projecting it by means of the top of the thumb (commonly called "fulking"); but these and the kindred methods must not, under any circumstances, be resorted to by those who would be even considered able

to play at marbles. To shoot properly, correctly, and accurately, the marble is to be placed just above the first joint of the thumb of the right hand, and held there by the tip of the forefinger, the top of the thumb being firmly grasped by the middle finger, bent for the purpose (see woodcut). The aim is then to be taken, and the thumb to fly with such force as to shoot the marble away with the required speed. With practice great skill may soon be obtained, a fairly good shot being able to hit another marble nine times out of ten at a distance of several feet. In marble games, as, indeed, in all shooting practice, it should be remembered that the object aimed at is to be steadily looked at, its exact position being thoroughly taken in by the eye; the marble to be shot being firmly grasped by a hand in strict obedience to the brain of the shooter, it will find its correct position without any guidance sensible to the player. In discharging the marble from the thumb great care is to be taken to keep the hand perfectly still; the forefinger knuckle should be made to touch the ground, and not moved until the marble has been fairly shot away. The success of a shot depends, next to the skill of the shooter, on the quality of the marble. It should be of the very hardest material, perfectly round, with no dents or cracks in it. The best marbles are known as "alley taws," or "alleys," and should be made of pure marble; but as this description is somewhat scarce and expensive, most players are content with one or

two, at the outside, of such treasures, to be used for special occasions only, making up their ordinary playing stores of marbles by a cheaper and commoner sort.

After the above remarks of a general nature as to the manner of shooting and the quality of marbles used, the various games commonly played may now be briefly described, it being first laid down as a rule in all marble games in which fines are imposed, or in which marbles are lost and won, that the fines or losses should not be paid in "alleys," but in marbles of the inferior sorts. The scarcity of the "alley" makes the universal recognition of this principle a necessity. As, however, much greater accuracy in shooting is obtainable with a genuine "alley" than with any other description of marble, it is often the custom to "bar alleys," that is, not to allow them to be used unless all the players are the fortunate possessors of one or more of these special articles.

ARCH-BOARD.

This game is also known sometimes by the name of Bridge-Board, and sometimes by that of Nine Holes. For it a narrow piece of thin board is required, in which nine arches are to be cut, each arch being a trifle over an inch in height, but less than an inch wide. Over each arch a number should be written, these numbers varying according to the general size of the arches, and according to the skill of the players. If the arches are small and the players indifferent shots, the numbers may be 0, 1, 2, 3, 4, 5, 6, 7, 8; higher numbers than these should never be used. The lowest numbers should be an alternation of noughts and ones. A mean between the two, however, will generally be the best to fix upon, and they should be arranged with the low numbers in the middle of the bridge, and the high numbers at the corners, something in the following order: 3 3 2 1 0 1 2 3 3 (*see woodcut*). One player is then to be made bridge-keeper, the remainder shooting from a point about four feet or four feet and a-half from the centre of the bridge. For every shot that fails to make any hole a marble is to be paid to the bridge-keeper, but for every successful shot marbles corresponding in number with that written over the arch under which the shot marble went, are to be paid by the bridge-keeper to the shooter. As the position of bridge-keeper is generally a lucrative one, he is to be changed at every round, and every player in succession should take his stand at the bridge.



ARCH-BOARD.

BOUNCE ABOUT.

This game is best played with medium-sized glass marbles, or with marbles known in the shops as "bouncers." Each player should know his own bouncer. The first player throws off his bouncer; player No. 2 follows, throwing thereat; then No. 3, in like fashion, aims at one or other of these, and so on. Every time one bouncer hits a bouncer that is on the ground, the owner of the ground-bouncer pays a marble to him who made the successful throw. "Bouncers," like genuine "alleys," are never to be forfeited, they are too scarce and precious in the eyes of their owners. A limited number only should play at this game—two is quite sufficient, and four should never be exceeded; a party should split themselves up into groups, if numbering more than four. It will be observed that throwing, not shooting, is the proper way to play at this game.

BOUNCE EYE.

A circle about a foot in diameter is to be made on the ground, and each player is to subscribe one marble to form a pool. The marbles comprising the pool are then placed in a cluster in the middle of the circle, and lots drawn to decide the order of the players. The first player then stands over the ring, and taking a marble between his thumb and fore-finger, holds it near his eye, taking aim so as to let it fall into the middle of the marbles in the ring. Upon the marble being dropped, any marbles driven by it out of the ring become the property of the player. If, however, no marbles are knocked out, the cluster is again formed, one marble being paid thereto by the player to atone for his unfortunate aim. So on the game proceeds until the pool is dry, when a new subscription may be made and the game recommenced.

BRIDGE-BOARD.

See "Arch-Board."

CONQUEROR.

This is not a game to be recommended, but rather to be put down wherever it is known to exist. Its whole object is the smashing of "alleys," and no genuine marble player will risk the weapon that he thoroughly understands and has skilfully used.

One boy, say Y, places his marble on a piece of smooth ground, while Z throws his marble at it with all his might, with the object of smashing Y's marble or having his own smashed in the endeavour. If the effort fails in both respects, Z places his marble on the ground, and Y throws at it, and so on alternately.

A marble smashing another scores one, and is in future known as a "oner," but if the marble smashed was already a "conqueror," say a "oner," then the marble that smashed it would count two and be a "twoer," and so on, the conqueror scoring one for every marble smashed, and in addition adding the rank of the smashed conqueror to his own.

DIE SHOT.

This game requires skill and caution in shooting, and the players should arrange themselves as in the game of Arch-Board; that is, one should be selected as the "die-keeper," who is to be changed with every round, so that all the

players alternately have the office. A marble ground down slightly at its sides is to be obtained, together with a cube-die, marked in the usual manner on its various sides from one to six. The marble is then to be placed on the ground with the die on the top of it (*see woodcut*). The various players then, in their different turns, knuckle down at a point from four to six feet from the die, and aim at it, endeavouring to knock it over. For every shot made, whether successful or the reverse,

DIE AND MARBLE.

the die-keeper has to be paid one marble, and every time the die is knocked off the player whose marble knocked it off receives from the die-keeper marbles corresponding in number with that which the die shows uppermost.

EGGS IN THE BUSH.

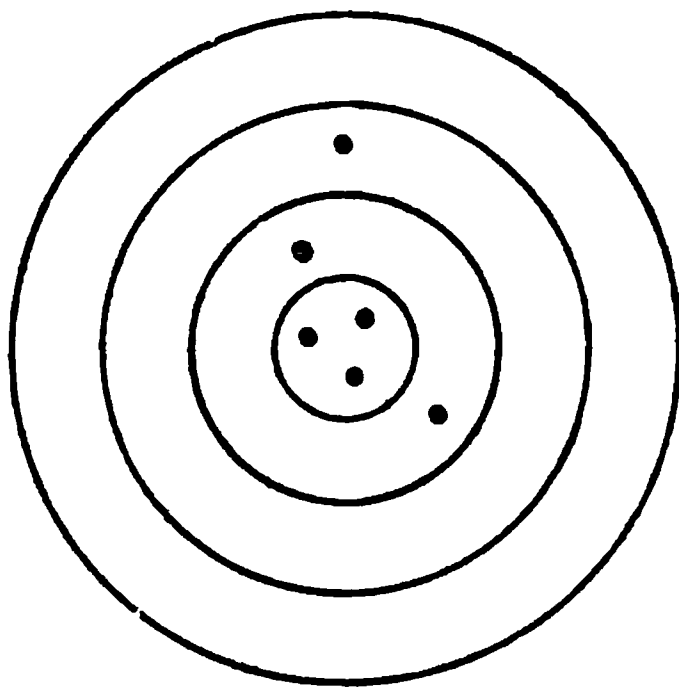
This is nothing but a guessing game, and may be played as well with marbles as with any other article that can be conveniently grasped in the hand. It requires no skill. A player takes up a number of marbles in his hand and closes

it, and asks his companion, or, as the case may be, companions, "How many eggs in the bush?" Each one guesses the number; those who guess rightly receive from the questioner a number of marbles equal to those held in the hand, those making incorrect guesses paying to him the difference in number between the guess and the number actually held out. Each player alternately has the privilege of holding out the Eggs in the Bush.

FORTIFICATIONS.

The game called Fortifications is but little known out of France, in which country it has obtained very considerable popularity. It is, however, nothing more than a variation of other marble games, differing but little, and that only in detail, and not at all in principle, from the more generally known game of Ring Taw, or the locally known game of Increase Pound, though, as a slight variation on this, it will be found interesting.

Several concentric circles should be marked out on a piece of tolerably level ground, the circles varying from six or nine inches to ten or twelve feet in diameter, the outer circle being at least two feet outside that next inside. The outer circle is to be left empty; in the first inner circle each player should place one marble, in the second two marbles, and in the next three marbles, and so on; but unless the players are very anxious for a long game, four circles, each player placing three marbles in the innermost circle, and two and one respectively in the next two circles, will be found generally sufficient (*see diagram*). The innermost circle is called the "fort," and contains the prize most to be desired. The players having decided the order of their play, No. 1 knuckles down at the outside circle and shoots his "taw," endeavouring to knock a marble from the second circle; if he succeeds he pockets the marble and leaves his "taw" where it rested; if, on the



PLAN OF FORTIFICATIONS.

contrary, he fails to secure a marble from the circle in question, he pays a forfeit of one to that circle. No. 2 proceeds in the same way, but no player shoots more times in succession, until every player has had a chance, than he placed marbles in the circle which is being attacked. Upon the first round being completed, No. 1 begins again, it being understood that no inner fortification be attacked until the one immediately outside it has been completely cleared. No player who has failed to secure at least one marble from the circle attacked is allowed to participate in the attacks on those within, but retires until a fresh game is started. After the first shot the player has to knuckle down where his "taw" rests, or if he elects to do so at any point on the outside circle; nothing is gained by striking an opponent's "taw;" but if it be struck it must remain at the spot to which it is knocked. A "taw" may be temporarily lifted to allow of a clear shot at a marble when necessary. Upon the attack on the circle in which the players have each placed two marbles a successful shot entitles the player to a follow; and when the next inner circle is attacked two successful shots give the right to a third try, and so on when the circles are more numerous, it, however, being clearly understood that every unsuccessful shot entails the penalty of one marble to be paid into the circle or fortification under attack.

HANDERS.

Handers, or Tip-Shears, is another of the many marble games in which chance plays a very considerable part. A small hole, about three inches wide, is made in the ground, at least a foot distant from a wall. The players decide the order in which they shall play by standing at a point a few yards away from the hole, and each bowling or pitching a marble towards the hole. The order of proximity in which the marbles lie to the hole is the order to be taken by the players. If more than one marble should have gone into the hole, the owners of those marbles throw again for the earlier places. Each player then subscribes one or more marbles, as may have been decided upon; the first player taking all, and throwing them together towards the hole, is considered the possessor of all that roll therein, return bounces not being counted. The remainder is then to be handed to the next player for a similar purpose, and with a like result, and so on. As each subscription is exhausted a fresh one is made, the player next in turn having first try with the new subscription. The winnings and losings are not so large when a condition is made that if the number of marbles falling into the hole is odd—say one, three, five, or seven—the player who threw them shall pocket none, but if an even number fall in—say two, four, six, or eight—then these will belong to him; or *vice versâ*, the odd number being taken and the even left.

INCREASE POUND.

Two concentric circles are to be made, the one with a diameter of from six to nine inches, which is called the "pound;" the other, known as the "bar," being ten to twelve feet in diameter. Each player puts one or more marbles into the pound; player No. 1, knuckling down at any point of the bar, shoots his taw at the pound. If he knocks a marble out it becomes his, if he fail his taw is to remain where it rests, if within the bar and outside the pound. If within the pound, the taw has to be lifted, and a forfeit of one marble paid to the pound. Player No. 2 follows, and may shoot either at his opponent's taw or at the pound, and if he hits the taw the owner thereof subscribes further to the general fund, and so on. If a taw struck by the taw of another player has, during the playing of the game, made any winnings, such winnings have to be handed to the owner of the last-shot taw, the taw struck being also fined, as stated.

KNOCK OUT, OR LAG OUT.

The order of the players being fixed, the first player opens the game by throwing a common marble against a wall, with force sufficient to make it rebound; the next player does the same, and so on, until a marble in its rebound strikes some other marble, when all the marbles on the ground become the property of the owner of the marble that made the successful hit. A line should be drawn at about two yards from the wall, and if any marble, in its rebound, crosses that line, it should be placed on the line at the point at which it crossed it.

LONG TAW.

This game is for two players only. Player No. 1 places a marble on the ground, and player No. 2 places another marble at a distance, of about two yards; both players then proceed to a point still a farther two yards distant. Player No. 1 knuckles down at this latter point and shoots his taw at the last-placed marble; if he hits it, he pockets it, and then shoots at the other; if successful again he wins, and the game recommences. Player No. 1 failing, however, to clear the ground, his opponent has a shot, not only at the marbles, but also at the taw. If the marbles are hit, the result is as it would have been had player

No. 1 succeeded; the same is the result, moreover, if he hits the taw, which entitles him to clear the ground.

NINE HOLES.

See "Arch-Board."

ODD OR EVEN.

This is similar in principle to the game of Eggs in the Bush. A handful of marbles is held out, the players round being asked "Odd or even?" Those who guess correctly as to whether the number of marbles held is odd or whether it is even receive each a marble; those who are wrong pay one.

PICKING THE PLUMS.

A straight line is to be drawn on the ground, and each player is to place thereon one or more marbles, the marbles being arranged at distances of about an inch apart (see woodcut). A parallel line is then drawn at a distance to be decided upon, but usually varying from four to eight feet. The order of the players is to be arranged in some manner similar to that described under the heading of Handers, and each one then, in proper order, "knuckles down" at the last-drawn line, and, by shooting his "taw," endeavours to pick a plum off the other line. A successful shot entitles the marksman to the plum, but not to a second shot. When the plums are all picked a fresh subscription should be made.



THE PLUMS TO BE PICKED.

PYRAMID.

Some enterprising boy is needed to start this game. He draws a circle on the ground and places in it a number of marbles—usually four—pyramid fashion, that is, three marbles at the three points of a triangle, the fourth resting on the top. He then charges those wishing to play a marble for a shot, which is usually taken at a distance of four, five, or six feet. All the marbles knocked out of the ring become the property of the shooter, and the pyramid has to be again formed, at the expense of the Pyramid-keeper. Pyramid-keeping is generally considered the more profitable part of the game.

BING TAW.

This is, after all, about the best of all the many marble games known. It contains in itself a happy combination of luck and skill that together go so far to make up that which is exhilarating in all games. A game of mere skill soon becomes wearisome from the very certainty of knowing beforehand what the result must be; while the mere game of chance fosters an unhealthy feverishness peculiar to the gambler.

A piece of fairly smooth ground should be selected, and on it a small circle, of about a foot in diameter, is to be drawn. Into this ring each player puts one or more marbles, as may be agreed upon, the marbles being placed, as near as possible, at equal distances from each other. An outer circle, the ring of which is some six or seven feet from the ring of the inner circle, is then to be made, the ring of which is called indifferently the "offing," "bar," "baulk," or "taw-line," and from it the various players shoot their taws.

The order of the players may be decided in any way, but some way similar to that described above in the game of Handers will generally be found to be the most satisfactory.

The opening player shoots his taw from the taw-line at the marbles in the ring. Should he knock one or more out he wins it or them, as the case may be, and is entitled to shoot again at the marbles from the spot where his taw rests. Whenever a player fails to shoot a marble out of the ring, the right of shooting passes, the succeeding players having the right to shoot at their opponents' taws, as well as at the marbles in the ring, provided always such taws remain at some point within the ring of one or other of the circles. A player hitting a taw receives a marble from the owner thereof, and is entitled to a further shot.

So on the game proceeds, until the ring is cleared. It should be insisted upon that no player may shoot at another player's taw more than once in succession.

SPANNERS.

This is a good simple game for two players. Player No. 1 shoots off his taw, player No. 2 following suit, it being his object either to hit his opponent's taw with his own, or to place his own within a span of it. Under either of these circumstances he is entitled to a marble from the first player. If, on the contrary, player No. 2 fails in his endeavour, No. 1 has a similar, or, it may be, a better, chance to win a marble.

TEETOTUM SHOT.

This game possesses a strong family likeness to that of die-shot. A teetotum in the charge of one of the players is set spinning, and for the privilege of shooting thereat from a short distance a marble is paid. If the shot hit the teetotum while spinning, the number uppermost on the teetotum when it falls represents the number of marbles to be paid by the keeper of the teetotum to him who successfully shot at it.

THREE HOLES.

This is a game affording good amusement to several players, and is in some districts as popular as that of Ring Taw. Three holes are made in the ground, each of them being about an inch deep and two inches in diameter, the distance between them being from a yard to a yard and a-half. The holes may be placed relatively in any position, but should be numbered one, two, and three, and must be played at in that order. A starting-point a yard and a-half from hole No. 1 is to be fixed, and the order of the players arranged. They each, in their respective turns, try to put their taws successively into the different holes, he who first succeeds winning a marble from each one of the other players. When the first hole has been passed, a player has the right to shoot at an opponent's taw as well as at the next hole, and as each successful shot entitles to a follow, the way onwards may be thus considerably helped, and in addition the owner of the taw hit has to pay a fine to the successful shot. No one taw may be hit more than once by any one other taw while passing between the same two holes. A hole successfully reached entitles to a following shot. The game may be continued up and down as long as time will allow or the players desire, a marble being collected all round every time a third hole is passed. Any player should be at liberty to retire from a game when he chooses.

In some districts variations in this game will be found; they are, however, but slight, and the above is not antagonistic to the practice obtaining in any district.

TIP-SHEARS.

See "Handers."

The principal marble games have now been exhausted; but before leaving the subject, we would urge all players to stop playing as soon as they find themselves caring more for the marbles lost or won than they do for the fun to be got out of the game. Winning or losing matters not one jot; fun, jollity, and amusement should come naturally to every healthy lad, at whatever game he may be engaged.

PLAYGROUND GAMES.

It is, from a superficial point of view, quite correct to say that many of the playground games indulged in by lads of school age are boisterous and rough; that they are senseless in their design and inartistic in the manner in which they are carried out; but, like most remarks of a superficial character, it needs but little penetration to detect the selfishness and affectation that underlie this apparently candid criticism.

The games described under this heading are, for the most part, recommended because of their simplicity and their ready adaptability to different circumstances; they may be played at by the poor lad just escaped from the public elementary school, as well as by the young gentleman let loose for a short period from the lectures of learned dons in the different University training schools. The boisterousness and roughness characteristic of some of the games, paradoxical as it may sound, give scope for the practice of "gentlemanliness," as well as gentleness; and by rendering necessary a hearty readiness to give and take, form a training for the real hardships that sooner or later come to all. Above all, they attain the object for which they were instituted, in affording a variety of fun, amusement, and recreation to hard-worked school-boys.

BASTE THE BEAR.

Lord Macaulay remarks, in his "History of England," that the Puritans objected to the old English pastime of Baiting the Bear, "not because it gave pain to the bear, but because it gave pleasure to the spectators." It is to be hoped that no one will prohibit the game of Baste the Bear for similar reasons.

From among the players one to take the office of bear is to be selected, and he chooses another player to act as his keeper. The bear, with a cord or rope about four or five feet long tied round his waist, has then to take his place, crouching on his hands and knees, within a circle of a yard and a half, or thereabouts, in diameter; the keeper holding the further end of the rope. The remainder of the players are then entitled to baste the bear, that is, to flog him on the back with knotted handkerchiefs. If, however, without the bear quitting the circle or getting off his knees, either he or his keeper can catch any player, that player becomes bear, and the first bear is released. Every bear has the right to select from the other players his own keeper.

Considerable difficulty is often experienced in catching a player in the limited space allowed to the bear and his keeper; but on the other hand it requires a good deal of nimbleness to give the bear a very severe basting.

BATTLE FOR THE BANNER.

Versions of this game will be found under different names; but the peculiarity in the game of Battle for the Banner is that a banner is the object struggled for.

The players are to be divided into two sides, each under a captain, the one side defending the banner, which is to be securely placed in the ground on the top of

a mound, the opposite side attacking and endeavouring to carry it off. The defending force should place themselves on and around the mound, and as the different members of the attacking force come up, should do their best to repel them. Pushing and wrestling are perfectly fair, both in the attack and the defence, and any member of either party being thrown or pushed to the ground is considered a dead man, and takes no further part in the play until the attack succeeds or the attacking force is all dead. Upon the banner being captured the attacking party becomes the custodian and defender thereof. It is quite needless to suggest to schoolboy ingenuity how a banner may very easily be provided.

BLACKTHORN.

See "King Senio."

BUCK, BUCK, HOW MANY FINGERS DO I HOLD UP?

This is a game for three boys, called respectively the Master, the Buck, and the Frog, who should alternately fill the various offices. The Master places himself with his back to a wall, and has to guard over the interests of the Buck. The Buck makes a back by bending down and placing his head at the pit of the Master's stomach. Frog then takes a leap and seats himself straddle-leg fashion on Buck's back, and asks the question that gives the game its name, at the same time holding up his right hand with or without some or all of his fingers distended. If Buck in answering has guessed the right number he is released, but if he has failed to do so Frog keeps his seat until a correct guess is made. The number of fingers held up may be varied after each guess. When the guess has been correctly made, Frog becomes Buck, Buck becomes Master, and Master becomes Frog, and so on with each change.

BULL IN THE RING.

Bull is to be selected from among the players, and for the office there will be many aspirants, as it is the post of honour in the game. He is to be enclosed in a ring made by the other boys joining hands around him. Bull takes his stand in the ring with arms folded "a-kimbo," and must not unfold them so long as the circle is complete. It is his business to escape by rushing, shouldering, or budging at the players forming the ring, and it is their business to prevent him. Bull will make his rush at that quarter where he thinks it will be least expected or where the ring is least firmly formed, and upon his forcing his way out he may unfold his arms and run away. The players then, loosing hands, join in pursuit, he who first catches the Bull being Bull next time.

If the Bull likes he may escape by dodging under the joined hands of any two of the players who form the ring; but this method of escape is considered to be *infra dig.* except for a boy smaller than the average of the other players; it should be a point of honour with the Bull to fairly force his way out somewhere or other. It is the custom also for the Bull to give warning every time he makes a rush by shouting "Boo!"

CAT AND MOUSE.

This is a game said to be of French origin, and it is hardly probable that other nationalities will be very pertinacious in claiming its invention. Two players only take part in the game, and they are to be blindfolded and tied to a tree or post by means of two long strings; the longer the strings the more the fun, provided the space they cover is all clear. One player is called the Cat, and the other the Mouse. The Mouse is to be provided with two pieces of wood, with

the edges of one piece so notched that upon its being rubbed on to the other piece it will make a grating sound. The Cat's business is to catch the Mouse, and the noise produced by the occasional rubbing together of these pieces of wood is his only clue to the whereabouts of the Mouse. Every time the Mouse is caught the players change places.

The brilliant genius who first planned this game had, no doubt, the amusement of the spectators in view rather than that of the players, but even then, and to the spectators, the fun must have depended entirely upon the effectual blind-folding of both the players.

COCK-FIGHTING.

This game evidently is another relic of the barbarity of our forefathers, and must have been suggested to some quick-witted lad upon hearing of the exploits in some cock-pit.

Cock-Fighting is a game for two; the players, with arms "a-kimbo," face, and lifting each one leg, hop towards the other, and while hopping and with folded arms each one endeavours by any and every possible means so to buffet his opponent as to make him seek the support of his lifted foot to retain his balance. He that keeps hopping the longest is entitled to a ride, "pick-a-back" fashion upon his opponent. The length of the ride should be decided before the play commences.

Another form of the game consists in each player putting himself in a sitting posture, and grasping his knees with his hands. While in this position, a stick is passed behind the bend of the knee and across the arm at the elbow joint, thus effectually locking him together, for so long as the stick remains in its place it is impossible for the player to stand up. Each player, when thus secured, jumps about butting at his opponent, the aim of each being, of course, to lay the other low.

CROSS TOUCH.

A considerable number of boys playing at Cross Touch in a limited space is about as much like a swarm of gnats on a summer's evening as a crowd of hearty boys can be like a swarm of gnats. To start the game a pursuer and a pursued have to be named, and it is the business of the pursuer to touch the pursued before any other player passes between them, or, before the pursued runs so as to place some other player between himself and the pursuer. The player so passing, or being thrust forward, is then chased, and so on until the pursuer succeeds in touching some player before he is crossed by any other player. This is an exceedingly pretty and lively game when entered into with spirit, but it requires a good deal of dash to keep up the interest of it.

DRAWING THE BADGER.

See "Fox."

DRAWING THE OVEN.

This is a game known in some localities as "Jack, Jack, the Bread Burns," but as neither name appears to be an exact definition and description of the game, it is well to give a few hints as to playing it.

The players represent, as far as two of their number are concerned, a baker and his man Jack. The remainder seat themselves in a row, one behind the other, each grasping firmly round the waist the boy sitting in front of him, and, so arranged, are supposed to be the batch of bread, comprised of many loaves, that is reported to be burning, and that requires to be drawn from the oven.

The master, after having called out to his man, "Jack, Jack, the bread burns!" rushes forward with his man Jack to help him draw the first loaf from the re-

mainder of the batch. This may be done either by fairly pulling the first boy in the row away from the one holding him, or by forcing apart the hands of the boy so holding, and thus detaching the first loaf from the batch. The same process is repeated until the batch has been completely drawn. This game is not recommended to big and strong boys, but the youngsters often find good fun in it.

DRILL SERGEANT.

This game will be recognised by many as an old favourite, more generally known as *The Fugleman*. The players arrange themselves in a line, and having selected one of their number to act as the Drill Sergeant, proceed to carry out his instructions, and to show themselves to the best of their ability to be a well-drilled squad. The Sergeant's instructions are simple in the extreme, but it is frequently found they are difficult of execution. They never vary, and are comprised in the double order of "Do as I do," and "Don't laugh." It will be readily understood that what is only strange if performed by one boy standing by himself becomes highly ridiculous and absurd when done in time by a row of say ten to twenty, and the result is, as may be expected, that the Sergeant sets such feats to be performed as will soon provoke a titter, if not a loud guffaw, from some member or members of the squad under his orders. The member laughing is set out, and as soon as half the squad is so disposed of the remainder jump upon their backs, having earned the right by a greater command over their risible nerves to a ride pick-a-back fashion round the playground, the Sergeant, armed with a knotted handkerchief, urging on the unwilling steeds by a timely application of the handkerchief to that portion of the laggard's person that is most get-at-able.

It should be understood that the Drill Sergeant may set no feat that involves moving away from the position he first took up. This regulation prevents any infringement on the rights of *Follow my Leader*, a game more fully described further on.

DROPPING THE HANDKERCHIEF.

A large ring is to be formed by all the players, except one, joining hands. Twenty players at least are required for a good game. The boy standing out takes a handkerchief and walks round outside the ring, flapping the handkerchief at every one's back until he chooses to drop it behind some one particular player. He then makes off, dodging in and out under the outstretched hands of those forming the ring, pursued by him behind whom the handkerchief was dropped, the gap in the ring being made up by the two boys standing next grasping hands. If the pursuer is successful in the chase he stands out and repeats the first process, the pursued joining in the ring, but if the latter eludes his pursuit he again has the office of dropping the handkerchief. The pursuer in this game, when played among boys in a playground, is bound to follow exactly in the wake of the pursued, dodging in and out of the ring in just the same places.

There is another version of this game also, known as *Kiss-in-the-Ring*, common at picnics, fairs, and out-of-door summer gatherings of all sorts, joined in by youths (and adults too) of both sexes. The mode of procedure, so far as dropping the handkerchief is concerned, is the same as above, except that the handkerchief is always to be dropped behind one of the opposite sex. In the chase that ensues the fugitive may dodge in and out of the ring, or run right away, followed, of course, by the pursuer, who is entitled to exact a toll of the pursued when the chase has successfully terminated. This toll is generally demanded and paid within the ring.

DUCK-STONE.

This is a game that may be managed by as few as three players; but with eight or ten, or even more, it makes a capital smart and interesting pastime, involving the constant use of sharp eyes and nimble feet. A rough lump of stone from nine inches to a foot square should be obtained and set up for a block, and the players should each be provided with a stone of about the size of a cricket ball. Stones that will not easily chip are to be selected for preference, and flints are always to be avoided.

A line is then to be drawn about fifteen to twenty yards from the block, the ground beyond the line being known as "home."

The players then, standing at home, "pink for duck," that is, they throw their stone towards the block, and he whose stone remains farthest from the block is first Duck.

Duck then places his stone upon the block, and takes his place beside it. The remaining players then throw their stones so as to try and dislodge the duck-stone, but if their throws fail their stones are impounded, and they are not allowed to touch them, except with the risk of being touched and made Duck, unless some one of their fellows is successful in dislodging the duck. In the event of the duck-stone being dislodged a general stampede to get home takes place, but if Duck can replace his stone on the block and touch any one running home, the one so running is made Duck; but sometimes when a sharp player is so touched he will immediately run and place his stone on the block and touch the former Duck again, before he has had time to recover his stone and run home. Upon this being done the new Duck does not lose his freedom.

If, however, as often happens, Duck's stone remains secure on the top of the block after all have had their throw at it, the players are at Duck's mercy, and have to make terms with him to get home again. They, or any one of them, may propose to take a "jump" home—that is, to take the stone between the feet and make for home so loaded by short jumps; or a "heeler" may be asked for, which is a kick by the heel of the stone homewards; or another alternative is to apply for a "sling," which consists in working the stone on to the fore part of the foot, and from there giving it a jerk towards home. If in attempting either of these the player fails in the "jump" by dropping the stone, or in the "heeler" or the "sling," by "heeling" or "slinging" the stone short of home, then he becomes Duck, and the block being by that means uncovered, the remaining players are all released and run home.

Duck may, if he chooses, refuse all these proposals and insist upon a run home; that is, that all shall pick up their stones and run for it, in which attempt Duck will be pretty certain to obtain his release, by managing to touch some one of the players.

When any player is attempting a "jump," a "heeler," or a "sling," no other player must attempt to get home, as Duck's attention will be fully taken up with the one who is endeavouring to come to terms and arrange a compromise with the Duck.

FLY THE GARTER.

This game consists mainly in jumping over a back, leap-frog fashion, the back being moved by degrees to a greater and greater distance from the point at which the jump has to be commenced, until some one of the players fails, when the game recommences with a new back.

The boy first to form a back should be selected in some manner agreeable to all; he has then to bend his back, placing his hands on his knees, tucking in his head (commonly known as his "tuppenny"), and elevating his shoulders. A garter is then to be made, usually a line of collected dust answers the purpose, and the

back placing himself alongside the garter gives the opportunity to all to leap over him. The players leap by placing their hands on the "back" and, straddle-legged, spring over. Should any player step on the garter he has to release the back that is down, and himself become back. After all the players have safely passed over, the last player calls "Foot it," whereupon the back places the heel of his right foot in the hollow of the left, then moves the left foot so that the hollow thereof covers the toe of the right, and next brings the right foot to a level with the left, when he will find himself a foot's length removed from the garter. The process of flying then proceeds as before, and so on, the back being instructed to foot it after each round. It is obvious that very soon the spring or fly must be taken before the hands touch the back, and it will not be long before either the garter is trodden upon or one of the players comes to grief in attempting the fly.

This game is also known as Foot It, or Foot and a half.

FOLLOW MY LEADER.

This is a game embracing within itself most of the peculiarities and eccentricities appertaining to that of Drill Sergeant or Fugleman, and also some of the practice inherent in that of Paper Hunt, included among the Field Games.

Choose one out of the number of players to act as leader, and as upon him will rest the whole responsibility of the game, and upon him will depend mainly what amount of fun and amusement will be had out of the game, see that he is both capable of leading and of a lively and amusing temperament. When the leader has been chosen, the remaining players arrange themselves behind him in single file; and the fun and sport then commence. Whatever the leader may do and wherever the leader may go, that the followers have to do and there they have to go. Any one failing in either of these respects is to be sent to the end of the line, and as every one will be anxious to secure the pre-eminence that excellence in performance as well as attention can secure, the playmates of the delinquent will be interested in enforcing this rule, and seeing that he takes the position assigned to those who shirk what the leader has done.

The game makes a capital introduction to such Field Games as Paper Hunt, Hare and Hounds, and Steeple Chase, as the followers have to go through whatever difficulties the leader may set, and it will astonish many to discover what feats they can accomplish when following others—feats which, were they by themselves, they would almost consider it foolhardiness to attempt.

The leader, too, although both capable and lively, should be considerate of the weaker ones among his followers, caring more to secure a willing following and to inspire each with confidence in himself, rather than to set astounding or hazardous feats—feats easy, perhaps, for an active big boy, which may probably be dangerous for a high-spirited youngster to attempt, but which it would be humbling to him to fail at, having once joined in the game, and thereby expressed his willingness to follow wherever led.

FOOT AND A HALF, OR FOOT IT.

See "Fly the Garter."

FOX.

From the fact that all the players arm themselves, for an offensive purpose, with knotted pocket-handkerchiefs this game bears some resemblance to that of Baste the Bear. One player is selected for first fox, and he is provided with a retreat, which no other player but the fox for the time being is permitted to

encroach upon or enter. Fox, to announce his readiness to commence, shouts out, "Twice five are ten," and upon being challenged in the words, "Fox, fox, come forth from your den," sallies out, hopping on one leg, and endeavouring to get a blow of his handkerchief on to the back of any one of the other players; they, in the meantime, belabouring him as best they can in the same manner. If Fox, while hopping, succeeds in striking any player, that one immediately becomes Fox, and under the blows of all is hasted to the den, having no power to strike in return until he has retreated, and after making the quotation given above has issued forth, hopping in the orthodox fashion. Should Fox, in his endeavours to obtain his release, lose his balance so as to be compelled to use both feet, he also is driven ignominiously home, without any power of retaliation.

This game will be familiar to many under the title of Drawing the Badger.

FOX AND GEESE.

See "King Senio."

FRENCH AND ENGLISH.

This is a game requiring strength combined with skill and judgment. Besides players the only material required is a long stout rope. Any reasonable number may join in the game, but the number most convenient, perhaps, is sixteen, divided into eight a side. The two most competent players should be selected to act as captains, and to officer the respective sides. They should alternately select their men, after having tossed for the first choice. A short line is then to be drawn and the rope placed across it, one half being on one side of the line, and the other half on the other side. The captains then take their places opposite to each other, alongside the rope, with their men behind them in Indian file, each about a yard apart, and all lift the rope with their right hands, the foremost man (generally the captain) on each side being about a yard and a half from the dividing line. A secure foothold is to be obtained by all, and upon the words, "One, two, three, ready, pull boys," being given, each side does all that strength, skill, and judgment can do to pull its opponents over the line. If a player is pulled across the line, he becomes a prisoner, and retires, the game then being virtually over; for if eight succeed in pulling successfully against eight, it will be understood that the remaining seven will not have much chance to withstand their victorious opponents. It does, nevertheless, happen frequently that the first victory encourages undue confidence and laxity, and if the captain of the weakened side is wise he can sometimes so advise his men as to enable them to pull over their antagonists in spite of the odds; but still, it must always be the case that the chief interest in the game rests with the first pull, and any *ruses* to be practised can be performed with more real effect then than after a man has been lost.

Sometimes it is allowed that a prisoner may be ransomed by any one of the same side offering himself in exchange, and it is generally well to permit this, for since the captain is usually first capture, his loss is so serious as to detract from the interest of the game by depriving one side of its most important officer.

This game is almost identical with Tug of War, as will be seen later on.

FRENCH HOP.

See "Snail."

FUGLEMAN.

See "Drill Sergeant."

GIANT'S STRIDE.

See "Swing."

HARE AND HOUNDS.

This is to all intents and purposes a field game rather than a playground game, but still it is, in a modified form, sometimes played in the more limited space. The modifications must be determined by the peculiarities of the ground in which the game is played, and it is recommended, therefore, that the description given under the heading of Paper Hunt, among the Field Games, should be thoroughly studied, and then but little difficulty will be experienced in introducing the required modifications.

HI COCKOLORUM.

See "Mount Nag."

HIDE AND SEEK.

This is an amusing game for youngsters when taken to be the out-door version of the game that when played in-doors is known in most places as Hot Boiled Beans. The name of Hide and Seek is, however, sometimes used as only another name for the game of I Spy, for a description of which see in proper alphabetical order.

HIGH BARBAREE.

This is another variety of the various games at hiding and finding, referred to under the headings of Hide and Seek, I Spy, and Whoop, all of which should be read together.

In High Barbaree sides are chosen, the one side going out to hide while the other side blind their eyes. The object of the stay-at-home side is, after a due lapse of time, to go out and search for their opponents, and to get home again without half their number being touched by those out hiding. Instead of half being touched, sometimes a definite number is fixed upon, and the game is then named High Barbaree *Three* caught he, or High Barbaree *Four* caught he, as the case may be. In the event of the number of the searchers touched being the number agreed upon, the hidiers are allowed to go out once more to dispose of themselves in as out-of-the-way places as they can. The finding side are at liberty, if they choose, to leave one of their number at home to give warning upon the unexpected appearance of any of the hiding side.

HIPPAS.

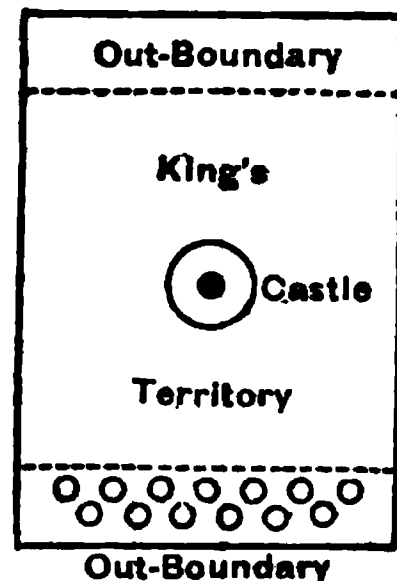
See "Knights."

HOPPING BASES.

Two bases are marked off at the opposite ends of the playground, and extending over its entire width are termed the "out-boundaries" (see diagram). The intervening space is the King's territory, in the centre of which a small space is marked out as his castle. All the players but one, who will have been elected King, take up positions in one of the out-boundaries, and it is their business to hop backwards and forwards from boundary to boundary without being touched by the King, who must also, whenever absent from his castle, be hopping. One out-boundary is to be entirely vacated before those who have attained the other attempt the return. All players once leaving a boundary are bound to attempt to hop across to the opposite boundary. All players touched by the King are claimed by him as his soldiers, as are also all those who make use of more than one leg in their passage from boundary to boundary; and King's soldiers, bound by the rules that bind their Sovereign, have to secure as many as possible to join them in their service. The King must leave his castle hopping, and if he uses more than one leg must return to his castle before he has power to touch

another player and claim his service. In the meantime, naturally, the other players will be making use of this opportunity to secure their passage across the territories of the King.

Another game, known as Hopping Bases, is played in the following manner: Boundaries at the extreme ends of the playground are arranged as explained above, and the players divided into sides take possession, the one side of one boundary and the other side of the other. Both sides then sally forth hopping to meet each other, and endeavour respectively to put their opponents down. Any player who loses his balance so as to use both legs when out of bounds becomes a prisoner of the opposite side, and is placed for safety in the corresponding boundary. A prisoner can be rescued only by one of his own side hopping right across the ground and touching him. The rescued prisoner and he who rescued him are permitted to return walking or running to their own boundary, and are then available to go forth to do battle again on their own side against the enemy. Any player is at liberty to hop back to his own boundary to take a rest; and, indeed, it is advisable so soon as prisoners have been made that some one or more players should remain at home to guard the prisoners, who may be placed in any position in the boundary that the captors order.



PLAN OF HOPPING BASES.

The side that retains most prisoners when time is called wins the game.

HOPPING ON THE BOTTLE.

This is a game but little to be recommended among boys, as, unless played with great care, it is apt to result in dislocated joints.

A wooden bottle, round log, cylinder, small tub, or some such object is to be obtained, and the player stationing himself two or three feet off has to stand on one leg and hop from the ground on to the object selected, and retain his position thereon on one leg. When this feat can be easily performed, two players, each standing on one leg on some round object of this character, may endeavour, by pushing or knocking, each to dislodge his antagonist. For the latter feat it is best that two tubs or cylinders of exactly the same size and shape should be used.

A variety of this game used to be played by the ancient Greeks on inflated bladders or skins well greased, the grease, combined with the rotundity of the skin, making it most difficult to obtain secure foothold.

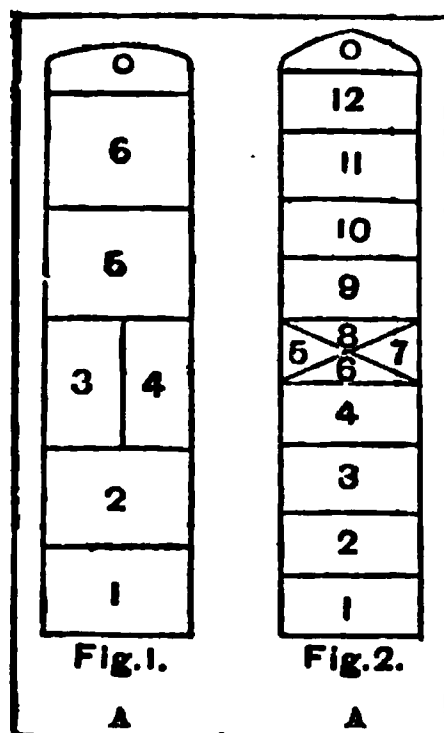
HOP SCOTCH.

The name and principal rules for the playing of this game must be thoroughly familiar to every child above the age of five or six years. It is almost impossible to walk along the streets of any ordinary-sized town without coming across some version of the familiar Hop Scotch diagram drawn on the pavement, and indeed it would be very difficult to find a ground more suitable for playing the game than is provided by the ordinary granite or asphalt paving.

Before playing, a piece of flat pantile, or oyster-shell, or a flat stone, to be called a "clipper," should be provided; a piece of flat and smooth ground should be selected, and on it should be drawn one or other of the accompanying diagrams. The number, size, and arrangement of the compartments of the

diagram or "Scotch" vary considerably, but those shown in Fig. 1 are of the simplest kind, while Fig. 2 gives a "Scotch" as difficult as most players are able to get safely through.

The order of the players, who ought not to be more than two at each "Scotch," is decided by pitching the "clipper" from a little below the first compartment towards the top compartment, which is distinguished from the others by the name of "pudding." He who pitches nearest to the small circle in that compartment plays first.



HOP SCOTCH DIAGRAMS.

The first player then takes the clipper at the point marked A, and pitches it into compartment No. 1; he then commences hopping, and proceeds to that compartment and kicks the clipper with the foot on which he is hopping towards the spot marked with the letter A. The clipper is next to be pitched into compartment No. 2, and kicked in the same way as before from there to No. 1, and thence again to the starting-point, and so in order, each time pitching the clipper to that compartment next highest in number to the one in which it was previously pitched, and kicking it from compartment to compartment in order until No. 1 is reached, and from thence always towards the point marked A.

A player is out, and the other player then tries his skill, if (a) the clipper is pitched so as to lie across any line, (b) if it is pitched into the wrong compartment, (c) if the player when hopping to kick the clipper puts down the raised foot until after the clipper has been properly kicked out of compartment No. 1, (d) if in hopping, the foot at any time touches one of the lines, (e) if the clipper is kicked so as to lie across any line, or (f) if the player fails to kick the clipper in proper order through all the numbered compartments.

An exception is made in respect to regulation c when the player reaches compartment No. 4 in Fig. 1 or compartment No. 7 in Fig. 2; he is then allowed a rest by placing one foot in No. 4 and the other in No. 3, or in 7 and 5, as the case may be.

When the highest numbered compartment has been reached it remains only for the player to pitch the clipper into the pudding compartment, and, hopping up to his clipper, with one good straight kick to send it straight towards home, so that it makes its final exit from the "Scotch" at the first compartment.

HOP, STEP, AND JUMP.

The players match themselves one against the other to see who can cover the largest space of ground from a given line by taking first a hop, then a step, and winding up with a jump. A run may be first taken in order to gain momentum and spring, but the hop must be taken at the line on one leg, the step and the jump immediately following.

HUNTSMAN.

One player is to be selected to be Huntsman, who takes his place within bounds allotted to him, the remaining players being scattered as they please. The Huntsman's object is to catch one of the players as soon as possible; after quitting bounds, the player caught having to carry on his back the Huntsman home again. These then, joining hands, start to catch another or others, those

caught always having to carry one or other of the catchers home. The game so proceeds until all are caught, when it may be re-commenced.

I SPY, OR I SPY HI!

This is one of the many games of "Hide and Seek," and is perhaps the most complicated and the best of them all. It affords to the players good fun and excitement, and at the same time gives considerable scope for the exercise of ingenuity and judgment. It requires a convenient locality where there is plenty of shelter and places suitable for concealment, and but few ordinary playgrounds are, without considerable adaptation, quite suitable for it. A ground in which are some ruins, or a common with an abundance of furze, will be found to be suitable; but best of all a farmyard in the summer time—when all the beasts are away in the fields—is the most suitable and convenient for the game of I Spy.

The players should be numerous, from sixteen to twenty-four being very suitable numbers, and they are to be divided equally into two sides, one of hiders and one of seekers.

The hiders go out and dispose themselves in such places as will best recommend themselves as adapted for the purpose of concealment. The other party remain within bounds, at a place called "Home," with eyes so averted that they cannot see the direction taken by the hiding party. After the lapse of about three or four minutes, the party at home shout aloud, "Coming once," and at the interval of another minute "Coming twice," a third shout of "Coming thrice" being uttered after the lapse of a further minute. In the event of no reply to these shouts, asking for further time, being received from the hiders, those at home, after the expiration of still one more minute, sally forth to find the members of the opposite side.

The object of the different hiders should be to issue forth from their respective places of concealment at such times as they will be able to touch one or more of the seekers before such seekers will have been able to reach home. The object of the seeking party is to spy out the hiders, and having spied any one hider, to rush home before that particular hider can touch any of their number.

The disposition of the different sides should be under the control of captains, whose business it will be to lay down for their followers a general plan of action. The captain of the hiders will denote the locality in which his various supporters should seek for concealment, and the captain of the seekers will arrange the order in which the ground is to be searched, and will generally find it expedient to leave at home some sharp-eyed follower who, when he sees a hider emerging from concealment, will give timely warning thereof.

So soon as any one of the party in search sees one of the opposite party, he should call out "I spy," naming the player seen and his place of concealment if still in hiding, which, if given correctly, compels the hider to emerge from his concealment, and, at the same time, warns the other searchers to run for home. If a hider, thinking by emerging quietly from his hiding-place that he can thus catch any of the opposite party, does so, and is seen in the open, the cry given is, "Home for —," giving the name only of the player so seen.

The seekers that reach home without being touched, after any of the opposite party has been duly called, are at liberty to proceed again to search for other hiders, but any searcher touched by the hiders before reaching home is out, and must stand aside until the game is re-commenced.

Any two hidere reaching home at the same time, unperceived, may shout to their fellows "All Home," and when this is done, a great haul of prisoners is almost certain to ensue. The precaution, referred to above, of posting one of the seeking-party near, or at home, to give warning, will of course prevent such a catastrophe.

If the hiding side manages to secure half of the searchers as prisoners they are entitled to another hide, otherwise the two sides exchange places.

JACK, JACK, THE BREAD BURNS.

See "Drawing the Oven."

JACK, JACK, SHOW A LIGHT.

See "Sam, Sam, Show a Light."

JINGLING.

This is a pastime very common in some parts, and is played at fairs and festive gatherings by adults, and it may occasionally be seen in those villages sufficiently old-fashioned to still remain the happy possessors of village greens. Although Jingling does not often come within the category of boys' ordinary games, the more is the reason why a short description of it should be here introduced.

The game is best played on grass, as it gives so noiseless a tread. A piece of ground should be roped off, into which the players are to be placed, all excepting the Jinger being blindfolded. The blindfolded players have to take up their positions around and just within the enclosure, the Jinger, provided with a small jingling-bell, being stationed in the middle. At a given signal the Jinger rings his bell, and it is then the business of the blindfolded players, or one of them, to catch him if they can. The game affords very considerable diversion to spectators when the Jinger is a smart player, and active in escaping the rushes of those endeavouring to lay hands upon him. Although not bound to be actually continuously ringing the bell, the Jinger must never allow more than a very few seconds, at the most ten, to elapse without jingling, as that sound is the only clue the other players can have to his whereabouts.

The Jinger is replaced by the first of the blindfolded players who succeeds in catching him.

JUMPING ROPE.

This is a very simple and common feat to perform. Two boys each take an end of a long rope, swing it round and round in as regular a manner as possible, in order to allow of other boys jumping up as the rope descends to so jump that the rope passes underneath their feet. The game is, indeed, nothing more than skipping on a scale somewhat larger than ordinary. Some dexterity will have to be shown in stepping in for the first jump, but afterwards the jumping has only to be regularly done to be kept up for an almost interminable length of time. Difficulties in the way of the jumpers may be arranged by those turning the rope, in varying the speed at which the rope is turned.

JUMP, LITTLE NAG-TAIL.

See "Mount Nag."

KING CÆSAR.

See "King Senio."

KING OF THE CASTLE.

"The King is dead, long live the King!" might be taken as a fair paraphrase of a description of this game.

A mound or hillock is to be selected as the King's Castle, which should be taken possession of by any one of the players, he proclaiming himself to be the proud occupant of the position he holds, and at the same time abusing his assailants by quoting the following lines—

"I'm the King of the Castle;
Get down, you dirty rascal."

It is necessary for the King to be thus emphatic, for he has no trumpet, no body-guard, and no assistance whatever to aid him to retain his position, whereas he is assailed on all sides by the other players, every one of whom is a claimant for the possession of the Castle; and each one, by fair pulls and pushes, is entitled to do what he can to dethrone the existing monarch, and to take possession and proclaim himself King. No King, with such tremendous odds against him, long retains the cares of the State, but the game is really good fun on a cold winter's day.

It is always to be remembered that only pulls and pushes at the King are allowed; pulling at his clothes is distinctly forbidden, under penalty of exclusion from the game.

KING SENIO.

This game is very similar to that of Hopping Bases, except the hopping. Two bases are marked out, one at each of the extreme ends of the playground, and of one of which all the players save one take possession. The out-player is selected in any manner satisfactory to the players generally, and is called the King. He takes his place at any position he chooses between the two boundaries, and it is his duty, as the other players run from base to base through the intervening ground, to catch them, to tap them on the crown of the head, and to say, "I crown thee King." The player so captured and crowned then devotes his energies to secure more kings from the remaining players, and so on. No player may leave the boundary at which he has arrived until the opposite boundary is entirely vacated. Any player placing both feet outside a boundary is not allowed to retrace his steps, but must proceed to the opposite boundary. When the kings or out-players become the majority, they may, if they choose, proceed to the boundary in which the remaining players are located, and by force drag them forth and crown them. When all have been crowned, the game recommences.

This game is variously known as King Senio, King Cæsar, Rushing Bases, Fox and Geese, and Blackthorn.

KNIGHTS.

This game is known also by the names of Hippas and Tournament.

The players take respectively the positions of horses and riders. The riders are usually the smaller boys, the horses being taken from those of stronger and heavier build. Sides are formed, and it is then the business of the riders, or knights, as they are called, on either side to unhorse their opponents, the knights being effectually aided by their horses.

The riders should take their seats firmly upon the shoulders of the horses, and their legs should be firmly grasped under the arms of the horses, to give a secure and steady seat. The knights then upon joining the tournament have

the free use of their arms and hands for purposes of attack, while the sturdy horses are allowed to buffet with their shoulders, sides, and bodies.

This game ought not to be played except upon grass, or when the ground is covered with some soft material, as the falls sometimes come unexpectedly and are heavy.

LAST MAN'S JUMP.

This is a variety of the game described under the heading of "Fly the Garter." The boy to offer the first back having been selected, he takes his position on the garter, and the players proceed to fly over him as in the latter game. The last player over, however, makes his leap or jump to as great a distance as he can beyond the back, and at that spot back offers himself for the next round, and so on. One jump in between the garter and the back is allowed, but it soon happens to the back to be released, as his rate of progress from the garter is rapid, and some player will soon find himself unable to cover the distance and reach the back, even although he is allowed the jump. Those players who fly from the garter take precedence of those who avail themselves of the jump in.

This game is occasionally played with an allowance of a hop, a step, and a jump within the garter, the respective players taking precedence according to how they manage without availing themselves of all or some of these opportunities. The extension of privileges to this extent is not to be recommended, as it has the tendency to keep one back down for too long a time.

LEAP FROG.

This is the simplest of all those games which consist in one boy giving a back for others to fly over, and is the most satisfactory in that all players are treated alike. It is capital exercise and good recreation on a winter's day when kept merrily going. And, indeed, it bears a striking resemblance in more than one particular to that most interesting game so graphically described by Mr. Lewis Carroll in his account of "Alice's Adventures in Wonderland," which is known as the Caucas Race, and which was commenced at the instigation of the Dodo for the purpose of affording exercise that would dry Alice and the others after they had so narrowly escaped drowning in the pool caused by Alice's tears. As in the Caucas Race, so in Leap Frog, the pleasure for all is equal, and all who join in the game win.

The players decide the order in which they start; the first boy then makes a back for the others to go over, and each boy as he goes over the last back down himself makes a back for all the players to go over. He is then entitled to go over the backs of all the others, and so on, the motion being kept up until stopped by the school or dinner-bell, as the case may be.

The distances between the backs should be about twelve or fifteen yards, and every player should give just such a back, high or low, as is required of him by the boy to take the leap.

LONG TAG.

See "Tierce."

MOUNT NAG.

The game of Mount Nag is also known by the names of Jump, Little Nagtail, and Hi Cockolorum.

The players are divided into sides, the one to act as nags the other as riders. In the case of the former, the first player stands erect, with his face usually, but not necessarily, to the wall. The next of the side forms down in the manner explained in the game of Buck, Back, how many Fingers do I hold up? the

remainder of the side forming down in the same way, each one "tailing" on and holding to the player immediately in front, in order to secure stability and to preserve steadiness.

The nags being thus all down, the riders one by one mount until all have secured a seat. It will be necessary that the first rider take his leap as far forward as possible towards the nag at the wall, in order that space behind may be left for the remaining riders, and that each succeeding rider vault as far forward as he can. No rider is allowed to move after he has once taken his seat, and every rider, before proceeding to take his seat, must give notice of his intention by calling aloud, "Here comes my ship full sailing—cock warning!" After the riders are all seated they have to shout aloud three times either the words, "Jump, little Nagtail, one, two, three," or "Hi Cockolorum, jig, jig, jig," calling at the third time the words "Off, off!" If the nags have throughout supported the riders, sides then change places. It is sometimes made a condition of the change in position of the sides that the nags, by wriggling and other manoeuvres, should unseat one or more of the riders, or that one or more of the riders touching the ground with a foot before the final "Off, off!" has been uttered puts his side out. Under either arrangement, however, the nags are released if any one of the riders fails to secure a seat on the nags owing to the earlier riders not taking their seats sufficiently far forward.

MY GRANDMOTHER'S CLOCK.

This and Winding the King's Watch are very similar games. In each the players join hands in one long line with arms outstretched. In the former game, that called My Grandmother's Clock, the player at one end of the line stands still and the others wind themselves round him until the line has become a spiral coil, when the players release hands and extricate themselves as they can. In Winding the King's Watch the two boys at the one end of the line hold up their joined hands as high as possible, while the player at the other end, called the King, wheels round, followed by all the other players, and go through the arch so formed without letting go hands, the process being gone through alternately at the opposite ends.

NICKY NIGHT, SHOW A LIGHT.

See "Sam, Sam, Show a Light."

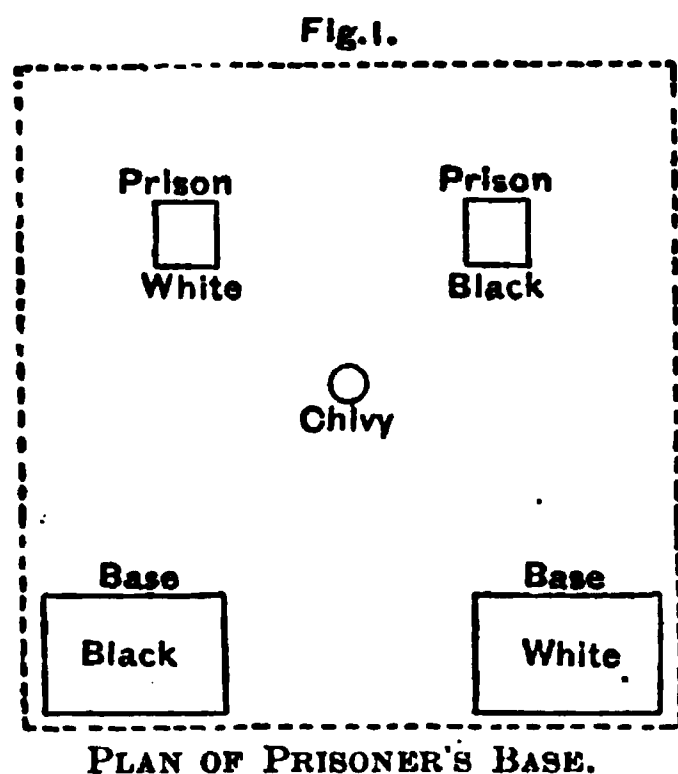
PITCH STONE.

Two boys take each a round stone weighing from two to four ounces and alternately pitch them, the one player pitching his stone at the stone of the other, but so as to hinder the opponent from hitting the stone when it becomes the opponent's turn to pitch. It is somewhat difficult to score many hits, for the stone thrown has to be sent in such a manner as to proceed a considerable distance after it has struck the stone that is down, or it will assuredly run a great risk of being hit when the next player throws.

PRISONER'S BASE.

In preparing the ground for this game, the nature and size of the space in which it is to be played must be taken into account. If the space be limited, the best arrangement that can be adopted is that shown in the annexed figure (Fig. 2), in which the whole space of the playground is taken up; but in a large field or playground, where it is not desirable to occupy the whole space for one game, Fig. 1 will be more applicable, it being understood that the dotted lines are

intended to represent no definite outline for the playground. The spaces at the bottom of the plans are known as bases, the smaller spaces opposite being the prisons; and it is advisable that the shortest distance from a base to a prison should not be less than twenty or twenty-five yards, but the distance may be



extended beyond that to almost any degree. It is also necessary that the bases should each be of sufficient length to contain the whole of the players on either side, when ranged in line.

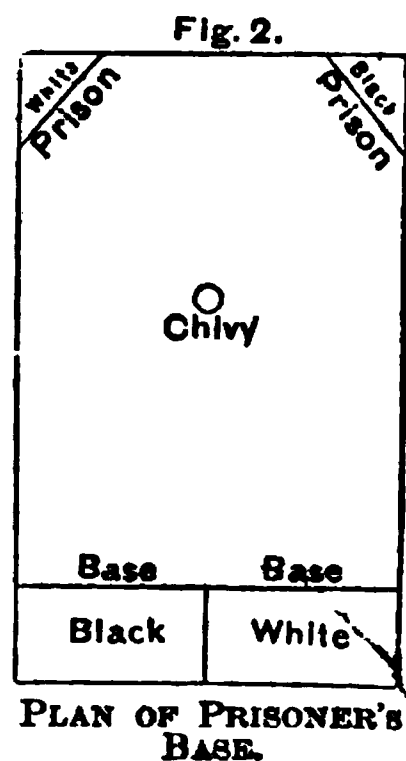
The players should be numerous, not less than twenty, and of an even number. From among the players two captains are to be selected, each of whom chooses a player alternately until all are chosen.

The different sides, referred to here and also in the plans as "Blacks" and "Whites," take up their positions in their respective bases; and the captains toss to decide which side shall first commence the game. The captain who loses then has to send out one of his men, known as "Chivy," to give the challenge; which being given a commencement of the game

ensues, and proceeds in the following manner. Chivy should not be one of the best of the players, as his office is mainly to act in the first place as a decoy.

Chivy is to be despatched into the centre of the field, at a point approximately equidistant from the bases and the prisons, and when arrived at that point gives the challenge by shouting, "Chivy!" upon which one of the opposite party starts in pursuit to give chase. Chivy is bound to run on at least as far as the confines of one of the prisons, but he may then use his discretion as to proceeding farther or making the best of his way home. Chivy having been selected from among the Blacks, will be pursued by a player from the Whites; who again will, directly he has started from home, be pursued by a Black; he again by a White, and so on; the captain on either side directing the order in which their men shall run out. Chivy alone has the benefit of the start into the middle of the field, the others being pursued immediately they have quitted their respective bases. Any player being overtaken and touched by any one of the opposite side, who has subsequently left his base, becomes a prisoner of the side that touched him. The player who has secured a prisoner has earned the right to an unmolested retreat home; but having touched one of his opponents, can neither secure more prisoners nor rescue any of his own side, until he has first been home. No player can be made prisoner by any one of the opposite side who left his base before him.

Prisoners are secured in prisons opposite to the bases of their opponents, and each is released by a player from his own side running from the base to the prison, and touching a prisoner without being touched in turn by one of the opposing party, who was at home at, or subsequently to, the time that he started. Both the rescued prisoner and the rescuer return home unmolested, and both have then full liberty to join afresh in the game.



A prisoner must take his place in the prison allotted to his side in such a way that at least some portion of his body is within the prison bounds; but if, as is frequently the case, more than one of the same side is imprisoned at the same time, it is sufficient if one prisoner is so situated, provided that the others, by joining hands, are connected with him in a continuous chain, the prisoners so formed being allowed to extend themselves towards the players in their own base.

The game goes on almost indefinitely; for it is not won or lost until the one side has succeeded in making prisoners of the whole of the enemy, an achievement rarely gained, for when the prisoners from any one side become numerous, the chain of connection they are able to form reaches so far towards home as to make the release of some of them a comparatively easy matter. On the other hand, if Chivy safely returns home, and no prisoners on either side are made, or when all prisoners on both sides have been rescued, the game is again started; Chivy being taken alternately from both sides.

Success in the game must, of course, depend, to a very large extent, upon the exertions of all the players; but still very much is owing to the captains, and in the operations for the relief of the prisoners especially there is often great scope for the exercise of tact and generalship.

PUSS IN THE CORNER.

This is a game as often played in-doors as out. It requires but five players, and, being of a most elementary character, the exercise of but a small amount of ingenuity.

Four players take up their positions at different corners, the fifth player standing out, and being known as "Puss." It is the object of the four players to change corners among themselves as frequently as possible, but so as to prevent Puss from getting into any one of the corners while it is vacant; and it is the object of the Puss to get into some corner when it is thus vacant. The player left without a corner becomes Puss.

ROUND TAG.

See "Tierce."

RUSHING BASES.

See "King Senio."

SAM, SAM, SHOW A LIGHT,

Or, as it is sometimes called, Jack, Jack, Show a Light, and again, Nicky Night, Show a Light, is another version of Hide-and-Seek, which can, however, be carried on only when it is dusk or dark.

The players, on a fitting evening, having divided themselves into sides, proceed, the one side to a base agreed upon, called home, the other to hide themselves, or to proceed to a distance sufficiently far away to render them invisible from home. The latter having so proceeded should then, from a bit of flint with a steel file or other convenient tool, strike a few sparks of fire for the guidance of the home party, which may then proceed in pursuit, the hiding party at the same time being at liberty to proceed on and on, or to change their hiding, as the case may be, with a view of eluding the seekers. The seekers having lost traces, call one of the various titles of the game, as previously to be agreed upon, when the hiding party again gives the clue as before. Under certain circumstances the hiding party is sometimes allowed a second outing; but it is best that the sides should alternately hide and find, that side being considered the winners which for the longest time is successful in eluding the search of the opposite party.

This game is sometimes played with a bell to ring or a gong to sound, instead of material wherewith to emit sparks of fire.

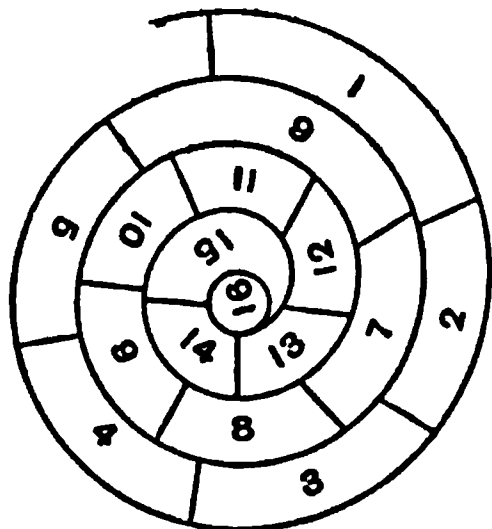
SEE-SAW.

Balance a long stout plank on a log of wood, a felled tree, a low wall, or some similar object. Then divide the players, except one, into sides, so that each side shall in weight, as nearly as possible, equal the other. Let each side next seat themselves, straddle-leg fashion, on the opposite ends of the balanced plank, first adjusting the plank to allow for any difference of weight in the players, the heavier side having the shorter length of plank on their side of the log. The player standing out, who rejoices in the title or name of Master Pudding, or Jack-o'-Both-Sides, then, with one leg on each side of the centre of gravity, in turn depresses and elevates each end of the plank by alternately shifting his weight from one leg to the other, in this being assisted by the side depressed giving a slight spring from the toes as soon as they touch the ground.

The players on either side should not number more than three, or at the outside four, and, indeed, it is better to have only one on each side, if the balance can be easily arranged, with Pudding in the middle, to play the part of Jack-o'-Both-Sides.

SNAIL.

Snail, or French Hop, is a version of Hop Scotch. The figure, instead of being of the form shown in the diagrams illustrating the game of Hop Scotch, is in the form of a snail, each coil being marked off into compartments (see diagram). The tile or "clipper" has to be started from the outer coil and kicked, the player hopping from compartment to compartment, without a rest, to the centre. A rest is then allowed, after which the clipper has to be kicked out again in the same manner. The rules laid down in Hop Scotch are applicable to this game.



SNAIL DIAGRAM.

SNOW-BALLING.

Snow when freshly fallen, and before it is either partly thawed or has become hard frozen, is in the best possible condition for binding, and the balls then made, when thrown, maintain their consistency, instead of falling into nasty jagged lumps, as they will do when the frost has once got hold of the snow.

The game is usually understood to be carried on promiscuously, it being generally taken for granted that any one has a perfect right to throw a snowball at anybody; this, however, is too sweeping an assumption, unless indulged in with a considerable amount of discretion, especially outside the playground, as boys have been known to get severe reprimands from policemen and other authorities, empowered to keep the public peace, when the said boys have successfully thrown a snowball at some unoffending passer-by.

Nevertheless, a good hearty game of snow-balling, in a playground or other enclosed space, among a lot of lads divided into sides, produces much fun and excitement, and if spite be not introduced, is quite harmless.

Let the youngsters take up their positions at the back, and busily occupy themselves in the making of good, round, and hard-pressed balls for their

seniors standing in front, and so shielding them, to throw at the opposing force, and it will be astonishing to see how fast and furious the sport will proceed, imparting a rich glow of warmth and satisfaction to all the parties engaged.

SNOW CASTLE, OR. SNOW FORT.

This recreation, like the last, can be indulged in with any degree of satisfaction only when the snow is in a binding condition. All the boys available should help to make the Fort or Castle by joining heartily together. They should each roll the snow into large balls of as nearly as possible an equal size, and place them together alongside and atop one of the other, the interstices being neatly filled in with snow gathered for the purpose, until an enclosed space has been made with snow walls of tolerable thickness, a space in lieu of a door being left for ingress and egress. Inside the enclosures steps should be made, to enable the defenders to see over the top, and to aid them in the defence of the stronghold against the attack to be made as described hereafter.

When the Castle has been satisfactorily completed, the players should divide themselves into sides, for the respective purposes of attack and defence. A few minutes being allowed for each side to store up a supply of snowballs as ammunition, the attack, on a signal being given, should be commenced. The attacking party are allowed to arm themselves with a short stout post, to use as a battering-ram, but the defenders are permitted to repel such assault by mounting the steps and the Fort walls, if they choose, and pelting the assailants with snowballs. Those of the attacking force not using the ram are allowed to pelt the defenders in a similar manner when they get the chance. In the absence of a post to be used as a ram, some enthusiastic member of the attacking force allows himself to be used as the ram, he being rushed feet foremost against the walls of the Fort.

Much additional strength becomes imparted to the Castle if it is allowed to stand for a night after it has been made. The snow, by lapse of time, settles down, and the foundations become more secure, and the walls more solid.

SNOW GIANT.

The Snow Giant is made in a very similar manner to the way in which the Snow Castle is built, only that the snow is to be made in the form of a big man. In the making of the Giant consists the pastime or sport, and the bigger the Giant the more the sport.

The Snow Giant, when completed, may, however, be utilised in various ways, that will naturally suggest themselves. As a magnified Aunt Sally he makes a useful figure for the game described under that name in the Field Games.

SPANISH FLY.

This is a game full of change and variety, and amusing incident. It embodies in itself some of the characteristics both of Leap Frog and Follow my Leader. One player is to be selected as first back down, and one from the remainder to act as leader. It does not matter who is leader, and both he and the first back may be fixed upon at random or by lot.

The players in turn leap over the back that is down, and so soon as all have been over, the process has to be gone through again, except that some variation in the manner of going over, or in the action that is made to accompany the going over, must be made with every round. There is a certain order in the variations that it is well to recognise; but if it is preferred, the

selection of the variations may be left to him who acts as leader. The variations most commonly practised, with their order, are here given:—

1. The over is to be taken in the usual way, with the left hand of the player towards the head of the back.
2. Return from the opposite side.
3. The back has next to be gone over cross-wise.
4. Return cross-wise from the opposite side.

The first four variations are frequently gone through several times, each player as he goes over in alternate series knuckling, pinching, slapping, and kicking; as, however, neither of these feats is difficult to do, the back down is generally well pleased to dispense with these changes, they being only punishment to him without doing much to expedite his release.

5. Take the over as in No. 1, holding cap in hand, but in going over leave the cap on the back. This must be done by every player, and those going over after the first three or four will have to exercise their skill and ingenuity in finding a safe lodgment for the caps. If, however, any player fails, he is down and becomes back.

6. Should the above be successfully done by all, the players return in reverse order from the opposite side, each one as he returns removing his cap without disturbing the cap of any other player. The last to go over in No. 5 will, of course, be the first to return in No. 6.

7, 8. The same done cross-wise in opposite directions.

9, 10, 11, 12. The same as 5, 6, 7, 8, using handkerchiefs instead of caps.

13, 14, 15, 16. Take the over in the four different directions, throwing the cap in the air while leaping and catching it again after the leap is finished.

17, 18, 19, 20. Again over in the various directions, each time with the cap balanced upside down on the head.

21, 22, 23, 24. Again over with the cap balanced as before, but in making the over, drop the cap so as not to allow it to touch the cap of any other player already on the ground, and leaping clear of every cap. In the rounds 22 and 24 the cap is not balanced on the head, but instead when the rounds 21 and 23 have been successfully made, each player in his proper turn picks up his cap with his teeth, and with his back turned to the boy that is down, throws the cap over his own shoulder and over the back. The leap has then to be taken from the spot where the cap fell in the rounds 21 and 23. If a cap when thrown in this way touches the cap of any other player, the owner of the cap thrown is down.

Many other varieties may be mentioned, but the above are the most usual, and it rarely happens but that in some one of these some player will fail, and so release the boy that is down, and the game then recommences. As the leader's position is the easiest, the back when released takes leader's place, the other players going down one.

STANDING JUMPS and RUNNING FLIES

are the names of two modes of jumping. In the first the players stand with both feet together toeing a given line, and by taking the spring as they stand ascertain who can jump the farthest. The practice of Running Flies is similar, except that a run is allowed, the jump being taken from the line. A longer distance can be covered with a Running Fly than with a Standing Jump.

Games under these names sometimes take the form of Fly-the-Garter contests, to ascertain the most adept at flying from the greatest distance over a back.

As jumping and leaping are parts of so many of these playground games, a few hints as to "How to Jump" cannot be here out of place. Jumping is not only a capital exercise, but it is a useful accomplishment, and as the distance jumped depends very much on how the jump is made, it cannot be too clearly understood that there is a wrong as well as a right way to jump.

The spring should be made entirely from the toes and the ball of the foot, and not at all from the heel. In straining the muscles for the spring, the knees

should be so bent as to bring the thighs down towards the calves, the muscles so stretched being suddenly contracted again when the spring is made, and the whole body straightened. By these means the spring from the toes sends the jumper on his way, the stretching and contraction of the muscles give the required momentum to the body, the momentum being also increased by the swiftness of the run taken before the spring is made. In alighting it is also important to fall on the toes, as a fall on the heels will be found to jar the whole body.

The standing jump has to be managed a little differently. The toes and the muscles of the calves and thighs have to be made use of as above in taking the spring, the arms and clenched fists being previously swung, to add to the impetus; but, in spite of the jar, to jump any considerable distance it will be necessary to alight on the heels. The practice of Standing Jumps is not to be recommended nearly so highly as that of Running Flies, and the practice of the latter, by strengthening the muscles and bringing them and the whole forces of the body into harmony, goes a long way to increase a person's jumping powers.

SWING.

Swings are many and various; they range from the rope hanging with its two ends fastened to the bough of a convenient tree, to the Giant's Stride. Swings of the former description may be readily rigged up, if only possession can be had of a good stout rope; but a simple swing, consisting of two uprights and a cross-beam, from which ropes are suspended, fastened together at about two feet from the ground, and provided with a seat, should be found in every well-arranged playground. Swinging on such an appliance can be indulged in alone, if the player anxious for a swing can get no one to help him. He should start the swing before jumping on, and then, by swaying his body so as to help the alternate rises and falls of the swing, he will find that each time he will swing higher and higher, until the swing at its highest is nearly on a level with the cross-beam to which the ropes are attached. Two boys standing face to face on the same swing makes a favourite exercise, and there are many pretty feats and tricks to be performed on the swing that need no minute description, as the love of variation will suggest them to any intelligent lad.

The Giant's Stride is a much more pretentious affair, and may be almost said to be a permanent structure. It consists of one tall upright of about twenty feet, with a revolving plate at the top, to which are attached through rings a number of ropes knotted, on which the players swing themselves round and round with veritable giants' strides. With a fairly tall upright and ropes proportionately long, it is quite possible, after the players have given the necessary impetus or momentum to the swing, for them to make a circle of from forty to sixty yards without touching the ground, or to take a series of jumps from ten to fifteen feet high. The players on the Giant's Stride should always aim at keeping their bodies in a line with the slant of the rope, or they will be apt to suddenly lose their balance, and come to grief. Giant's Stride, however, is more properly to be looked upon as a gymnastic exercise; and in this light it has already been dealt with (p. 189).

TAG.

See "Touch," and also "Tierce," for the variations known as "Long Tag" and "Round Tag."

THREAD THE NEEDLE.

This game is similar to that of "Winding the King's Watch," a description of which will be found under the heading of "My Grandmother's Clock." The

game, however, when played under the title of Thread the Needle, has the following dialogue imported into it, the dialogue being carried on between the two players at the opposite ends of the line, each alternately taking the office of "king":—

Question by the King: "How many miles to Babylon?"

Answer: "Threescore and ten."

Question: "Can I get there by candle-light?"

Answer: "Yes, and back again."

Statement by King: "Then open the gates without more ado,
And let the king and his men pass through."

The king, followed by all the players, then passes through the arch formed at the opposite end of the line.

TIERCE.

This game also is known by the respective names of Round Tag or Long Tag, according to the manner in which it is played. In either version of the game the players, to ensure plenty of fun, should be numerous, never less than twenty. One should be selected as "He," or the out-player, and the remainder should arrange themselves, if the round game be played, as shown in the accompanying diagram. It will be seen that at every station two players are placed, and that at the station No. 1 a third player is placed towards the centre of the ring. It is the object of "He" to touch the outside player at the station at which three players may be, but upon the approach of "He" the outside player at the station No. 1 runs off and places himself in front of some other couple, when the outside player at that station becomes the object of pursuit. So soon as the outside player at any station makes off the remaining two step back so as to complete the double ring at that point. The player pursued is liable to be touched and to be made "He" until he

comes to rest in front of some one couple of players. "He" should always start from the point marked in the diagram, and the station with three players should, in the first instance, be at the farthest possible point from the position taken up by "He."

In Long Tag the couples are arranged in rows instead of circles, the Tierce station being at one end and "He" at the other. Either version of the game is good and popular, but perhaps Round Tag has the preference.

PLAN OF TIERCE.

TOM TIDDLER'S GROUND.

This game might be shortly described as the little boys' version of the game of Rushing Bases. One boy is to be selected as Tom Tiddler, who should have a considerable base or territory allotted to him, and in which are supposed to be vast stores of the precious metals. The other players promiscuously invade this territory, and as if they were picking up and pocketing the treasure, call attention to themselves by shouting—

"Here I stand, in Tom Tiddler's land,
Picking up gold and silver."

If Tom can touch any player while trespassing within his bounds, that player becomes Tom Tiddler, the guardian of the imaginary wealth buried in the soil.

TOUCH.

In the various games of Touch, the player whose office it is to touch another is known by the descriptive pronoun "He," spelled with a capital H.

In the simple game of Touch, "He" tries to overtake and touch some other player; which, when done, the player touched becomes "He," and proceeds himself to touch some one. The players generally must keep their wits about them to know who "He" may happen for the moment to be, as the office shifts from one to another very rapidly.

TOUCH WOOD, AND TOUCH IRON.

In these versions of the game, the players are safe from "He" during the time they may be touching wood, or touching iron, as the case may be, according to the game being played.

TOUCH WOOD AND WHISTLE.

This version of the game of Touch requires not only that to insure safety from the ubiquitous "He" the players should touch wood, but that they should also whistle. So soon as a player ceases to touch wood or to whistle, he is liable to fall a prey and be converted into "He."

In some parts of the country, gentlemen who happen to wear a white hat appear to have a peculiar effect upon the players, who cry, "Touch wood and whistle—man with a white hat!" And until wood is touched and a whistle performed, and so long as the white-hatted person is in sight, the unfortunate boy unable to accomplish these things is duly pinched.

TOURNAMENT.

See "Knights."

TUG OF WAR.

This is very similar to the game of French and English, and differs from it only in this respect, that when the first of the losing team is pulled over the dividing line between the two parties the tug is considered lost, and another trial has to take place. The best two tugs out of three is usually taken to decide a match, but three out of five is sometimes thought to offer a more satisfactory test of the relative abilities of the competing teams.

TWO TO ONE.

This is a feat to be performed with a common skipping rope. First, in order to get some way on the rope, skip in the ordinary manner; then take as high a leap as possible, and, at the same moment, accelerate the speed of the rope, so that in the one leap it will twice pass under the feet.

WALK, MOON, WALK!

Moon is to be selected from among the players and blindfolded. The players having knotted their pocket-handkerchiefs, Moon then stands in an open space with his legs apart, and through the arch so formed the pocket-handkerchiefs have to be thrown. When this is done, the instruction, "Walk, Moon, walk!" is given, and he is not released until he manages to step on one of the handkerchiefs, all of which will have been sent to some distance, and not necessarily in

any one direction. The boy whose handkerchief has been stepped upon next takes the place of Moon, but he has first to run the gauntlet through all his fellows, armed now with their handkerchiefs, to a given base and back again.

WANT A DAY'S WORK?

In this game are combined trials of strength between boy and boy, with fun and amusement caused by ingenious mimicry. A master has to be selected from among the players, and to him has to be allotted a piece of ground, called his shop. At the shop the other players present themselves, and are asked whether they "want a day's work?" the answer being given in the affirmative; upon being asked their trade, they answer as they choose, a blacksmith, a tailor, a tinker, a carpenter, a bricklayer, or what not, and then have some imaginary work, peculiar to the trade they have selected, given them to do, and so far as they are able they have to imitate the actions of the actual workers in the particular trades chosen. When the shop becomes tolerably filled, the master proceeds to an imaginary examination of the task, so far as it is supposed to have been completed, and, if satisfied, passes on; as, however, it is not in the nature of masters always to be satisfied with their workmen, so it is the case here, and after the unsatisfactory workman has been soundly rated and reprimanded, the master has to turn him out of the shop by sheer force, and then proceed with the expulsion of some other unsatisfactory hireling. Should, however, a workman succeed in the struggle to eject the master from the shop the game recommences, the stronger or more skilful player being next time master.

WARNING.

Bounds from fifteen to twenty feet in length should be arranged against a tree, a wall, or a fence, and in it should be placed a player selected from the rest to be "Cock." The remaining players station themselves about the ground as they please. When all are ready the cock clasps his hands in front of him and calls aloud, "Warning once, warning twice, a bushel of wheat, and a bushel of rye, when the cock crows out jump I." He then, with his hands clasped, jumps out of his bounds, and pursues the players generally until he succeeds in touching one, still keeping his hands clasped. The player touched and the "cock," who now unclasps his hands in order to join hands with the one touched, make their way quickly for bounds, as if they are caught on their way the players catching them are entitled to be carried "pick-a-back" fashion to bounds. The "cock," and his "chick," as the out-players when captured are called, next start hand-in-hand endeavouring to secure a third, and so on. Each time a "chick" is captured, he, as well as those who started from the bounds, may be ridden home if captured, and if the "cock" and his "chick" loose hands while in pursuit they are under the same penalty until they have again reached home. The last "chick" to be caught is "cock" next game.

WHOOOP.

This is a game of hide and find. All the players go out to hide except one, who stays at a spot called home, with his eyes closed or averted until the other players have all hidden themselves away. The last of the hiding players who finds a safe retreat calls "Whoop!" when the seeker leaves home to find those who have hidden. To be released from his office of finding he must find and touch some one of the hidiers before they can all reach home. If he does not succeed in this, and all the players can reach home without being touched by the finder, they proceed to hide again; but upon any one being found and touched, "All home!" is called, and the one touched has then to find.

WIDDY WIDDY, WAY.

See "Warning." The call, however, instead of being that given under the heading of Warning, is, in those parts of the country where the game is known under this title, "Widdy Widdy, Way—Cock Warning."

WILL YOU 'LIST?

Two recruiting sergeants should be selected, or two boys wishing to play the game should appoint themselves recruiting sergeants, going about shouting, "Will you 'list?" "Will you 'list?" each sergeant securing as many soldiers as he can, whom he should arm with a stick, a reed, or some such thing, as a weapon. After the enlisting is finished a certain amount of drilling and training should be gone through, and one sergeant with his men should then challenge the other sergeant with his men to combat. The combat consists in wresting away the weapons with which the soldiers have been armed, a soldier disarmed being considered *hors de combat*. As every soldier has to retain his own weapon while disarming an opponent, this game affords good opportunity for exciting struggles. It is well that the sides should manage to be pretty evenly matched.

WINDING THE KING'S WATCH.

See "My Grandmother's Clock."

TOPS AND TOP GAMES.

Tops generally are deservedly favourite toys, and afford in various ways amusement and healthy recreation. They may be divided into two classes: the mechanical tops, such as the chameleon, the humming, the globe, and others of a like mechanical construction, new variations of which may be looked for just before Christmas in any year at any large toy-shop; while on the other hand the old-fashioned peg-top and whipping-top to which the rotary motion called spinning can be imparted only by the skill of the player, are still the prime favourites, and hold that position just because they are independent of mechanical contrivance.

Top games are almost invariably played in connection with the peg-top only.

CHAMELEON TOP.



CHAMELEON TOP.

The chameleon top (see figure) is one of the most interesting of the mechanical tops. The necessary instructions for setting it in motion will be found printed and enclosed with the tops when they are purchased, but no skill is required in their manipulation. A piece of cord is wound round the upright stem of the top; the point of a small instrument supplied with the top is inserted in a small hole at the top of the upright. This

instrument is held with the left hand and pressed down with the thumb. The string should at the same time be pulled sharply away with the right hand, and the top will thus be set spinning.

The disc of the top is marked with variously coloured lines, and when the top is spinning, the central part being touched gently with a piece of wire, the point of a pencil, or any convenient object, remarkable changes of colour will be

produced on the disc. Small pieces of wire of various shape, also supplied with the top, are in addition to be fitted one by one into the hole in the upright, and as the top goes on revolving with the wires they assume all sorts of fantastic shapes. Small cardboard discs, variously coloured, may also be attached to the top to produce still further the changing shades and hues of the real chameleon; these discs when revolving should, to facilitate the exhibition of the changes, be touched with the tip of the finger.

CHIP STONE.

The game of Chip Stone is played on hard and smooth ground with peg-tops, shallow spoons or ladles, and small smooth stones or pebbles.

Two lines about six feet apart should be marked on the ground, and each player should place a stone or pebble midway between the lines. The players, provided with a spoon apiece, should then spin their tops, and when spinning each player has to lift his top in his spoon and drop the top, endeavouring to make the peg thereof strike the pebble he placed so as to knock or "chip" it out of bounds. So long as the top keeps alive, that is, remains spinning, this performance may be repeated, and when the top is dead it must be again set spinning. That player becomes the winner who first succeeds in knocking his pebble out of bounds.

Marbles and buttons are frequently used instead of stones or pebbles, and it is then the custom for the winner to retain the buttons or marbles, as the case may be, of the other players as his own property.

It is often the case that spoons or ladles are not readily procurable by boys at play, and it is as well, therefore, to let such boys know that the spoons are not absolutely indispensable, and that the palm of the open hand will be found to all intents to answer every purpose.

FLYING TOP.

This is an ingenious mechanical toy. It is a top fitted with wings made of cardboard placed at certain angles. The spinning motion being imparted to the top in the usual way by the aid of a piece of cord twisted round and suddenly uncoiled, the top takes flight and rises some distance, ultimately returning, if the ways of the top have been studied, and it has been carefully and judiciously started, to the hand of the player.

FRENCH TOP.

This is a pretty but rather expensive toy, and in an ordinary way is rarely used or seen; indeed, it is only attainable at some of the largest of the toy-shops. It is a case, in the form of a top, containing within it a number of shallow tops of a conical shape, and to keep it all properly going will require some amount of lightness of hand and ingenuity.

The top is usually known and described as a French Top, but it is of Japanese origin, as indeed are many tops and top-games, top-spinning being essentially a Japanese pastime.

GLOBE TOP.

The Globe Top (*see figure*) is a very ingenious mechanical toy, and it can be made to spin in a number of eccentric positions. It consists of a central wheel fixed on to the middle of a bar supported at its two ends in an outside ring. The central wheel is so placed and the bar is so supported that the wheel is capable of revolving within the outer ring. The bar at one end protrudes through the ring, and has a nut fitted to keep it in place.

To that end of the bar a string is attached, and the central wheel is set and kept in motion by pulling the string, the outer ring being at the same time rather firmly held in one hand, or suspended in some fixed position. Practice will indicate the different directions in which the top may be made to spin.

HUMMING TOP.

Humming Tops are so called from the noise they make when spinning. They are made hollow, either of wood or metal, and a hole is cut in one side, to cause the humming sound.

GLOBE TOP.

The simplest form of humming top is that which is spun by means of a cord and a handle. The handle is to be placed on the upright of the top, a round hole being bored through the handle for the purpose; the cord, which should have previously been fairly wound round the upright, should at the unwound end be passed through the fork that will be seen at one extremity of the handle. The handle has then to be firmly grasped in the left hand, and the string to be sharply pulled with the right hand, but with a gradually accelerating motion. The string must be no longer than can be easily unwound at one pull. The top, which will of course have been held just touching the ground, will now rapidly revolve with a loud humming sound, the handle and string being left in the player's hand. If the top has been cleverly spun, it will keep spinning for a long time, going to sleep in the middle—that is, it will go round so swiftly yet evenly that it will emit no sound, but on waking up, and previous to dying, its humming will recommence.



MECHANICAL HUMMING TOP.

A Humming Top still more mechanical in its construction is to be purchased now at almost any toy-shop (see figure). It is made of metal, and contains in the upper part a spring, which has merely to be twisted round before the top is set going.

Upon the spring being released the top spins at a speed and for a length of time in accordance with the degree of tightness to which the spring was twisted.

PEG-TOP.

It is a peg-top that every youngster is ambitious to possess, and to be able to spin. More games are to be played with peg-tops, and more amusement to be had from them, than from all other kinds of tops put together.

Roughly speaking, peg-tops are pear-shaped, with an iron peg inserted at the thin end; but as pears differ in shape, so do peg-tops. Some are very much rounder than others, but all sorts are useful for different purposes; and as they are comparatively inexpensive, it is well to be provided with several in which the shape graduates from round to elongated, and which have pegs of various lengths. The wood of which peg-tops are made is deal, elm, or yew-tree; but there is a special top, the king of the peg-tops, the Boxer, which is made of hard boxwood. The boxer bears about the same relation to the ordinary top that the genuine "alley law"

does to the ordinary marble: it is a possession to be highly prized, and not lightly risked. The pegs of the tops differ very much, both in shape and size, some being short and thick, some medium; others again are long and tapering. Generally speaking, it may be said that a top with a short thick peg is likely to spin steadily—to go to sleep, as it were, while spinning; whereas the top with a long thin peg travels about a good deal, and is very active in its movements. These characteristics will be found to be more or less developed according to the shortness or length of the peg.

To spin a peg-top successfully is not to be come at by chance, it must be patiently practised, and then only will the player be able to make a top spin as he may wish. The following remarks are, however, given for the guidance of novices, as carrying out these instructions is essential to spin a top at all. A piece of cord, varying according to the size of the top, should be procured, and to it at one end should be attached an ordinary shank or livery button; at about an inch from the other end a knot should be very tightly tied, the length beyond the knot being ravelled out. The top should then be taken in the left hand, the string or cord being held in the right. The unravelled end of the string, slightly moistened, is then to be laid along the side of the top, at the point where the peg is driven into the wood. It will now be observed that the lower end of the top is marked with a coil of slight circular grooves. Round the top in these grooves the cord is to be wound over the moistened and unravelled end of the cord until the button at the other end can be placed, and held tightly between and behind the two last fingers of the right hand, and with the thumb at the same time placed on the peg. The whole toy so held is then to be lifted above the head, and thrown in a curved line smartly to the ground, the cord being retained in the hand by the button secured between the two last fingers. Just before the string finally leaves the top it should be jerked, in order that any tendency to adhere on the part of the moistened end may be counter-acted. It should be stated here that it is in the peculiar manner in which this jerk is performed that given kinds of spinning are obtained; but on this subject no general instructions will be of any avail: the results of the different jerks must be noticed and acted upon.

With this description of the peg-top, and how to spin it, we will pass to an account of the game of

PEG-IN-THE-RING.

The preceding remarks on the peg-top having been duly studied, the game of Peg-in-the-Ring may next be proceeded with, and it will be found that it is the best of the peg-top games. It should be played as follows:—A circle, about three feet in diameter, has to be drawn on the ground, and then it has to be decided who shall first cast his top into the circle or ring, and the order of the succeeding players. The first player casts his top within the ring, and whilst it continues spinning the others are at liberty to peg their tops at it, or at the top of any other player who may have in the meantime cast in. So soon as all the players have cast in their tops, the first player may remove his, and himself peg at the others, and then the second, and so on; but after the first round no more than one top may be taken up until another has been cast.

Should any player fail to spin his top when he throws it, or fail to cast it within the ring, or take the top up from the ring, except in the proper order, or should it, on ceasing to spin, lie in the ring, the top is called "dead," and either is set in the middle of the ring or left where it falls, as the case may be, for the others to peg at. Any top hopping out of the ring, while still spinning, may be

taken up out of the proper order, and the owner has an additional right to peg at those tops within the ring. If a top that is dead should chance to be pegged out of the ring, it becomes alive again, and the owner may at once, without waiting his proper turn, resume his play with it.

The object of each player is either to split the tops of his companions, and thereby gain the pegs of the tops as trophies, or by striking his companions' tops beyond the boundaries of the ring, enable them to resume their play.

It will be gathered from the above that a travelling top, or "hopper," is the most desirable with which to play at Peg-in-the-Ring; it is well, therefore, that the long-pegged tops should be selected for the purpose, and that the peculiar jerk, already referred to, should be studied.

Skilful players with the peg-top are able to throw the top in such a manner that, if it should miss the top at which it is aimed, it leaps out of the ring at a single bound, thus preventing the other players from having a chance of hitting it. This is done by drawing the arms smartly towards the body just before the string finally leaves the top, and when the top has nearly reached the ground or top to be struck. This trick, or knack, requires some practice, but when attained will be found very useful for players at Peg-in-the-Ring.

In some localities marbles are combined with tops, and whenever a top falls dead a marble is placed within the ring instead of the top, and the marble becomes the property of the player who can strike it with his top and drive it out of the ring. Instead of spinning with one top only, it is sometimes allowed to the players to use as many tops as they please.

SPANISH PEG-TOP.

This toy is a mild variety of the ordinary peg-top. It is generally made of mahogany, and, instead of a peg to spin upon, is fitted (see figure) with a small round knob. It is more commonly used in-doors, on a wooden flooring, than out of doors, on the ground, and it spins for a much longer time than the common peg-top. To spin it, it is thrown from the hand, with a sort of "underhand" chuck, and not lifted over the head and smartly thrown to the ground, as is the peg-top proper.



SPANISH
PEG-TOP.

WHIPPING TOP.

The Whipping Top is second only in general interest to the peg-top; but even behind that it stands at a long distance. A whipping top should be selected, as regards its size and shape, with discretion: let it not be too high for its width, or it will overbalance itself; and let it not be too short, or it will present insufficient surface to the whip to be easily struck. The whip may be of various sorts of material: soft leather, a few boot-laces, or a piece of rope the twisting of which has been partly undone, fastened to a stick, for a handle, will do; but the most serviceable lash will be found to be that made of an eel's skin. The top is set spinning by turning it sharply round with the two hands; it is kept spinning, and the speed of its revolutions increased, by the judicious application of the whip.

WHIZ-GIG.

The Whiz-gig is an old-fashioned, but was formerly, at any rate, a favourite toy, emitting a sound similar to that proceeding from the humming-top. It is a hollow disc of wood with an opening in its side. By alternately coiling and uncoiling the cord on which it is strung it receives a circular motion, producing a loud buzzing sound as it goes round.

TOY GAMES.

UNDER this heading will be found a few of those simple out-of-door games played with toys that could not be appropriately placed with any of the other classifications. They are suitable for small spaces of ground, and when space for the more ambitious games is wanting an agreeable pastime may be found in some of the following amusements:—

BAGS.

In Canada and the United States Bags is a highly popular recreation, and it is a capital warming game in cold weather. The game is played with four cotton bags, half filled with dry peas, the bags being tied at the mouth. These bags are taken up by two players, two bags each, one bag in each hand. Player No. 1 throws the bag in his right hand to Player No. 2, transfers the bag in his left hand to his right, catches a bag sent by No. 2 in his left hand, throws to No. 2 the bag in his right, transfers the bag in his left to his right, and so on. Player No. 2 does just the same as No. 1; indeed, each player should consider himself to be No. 1, and his companion No. 2. The object of the game is to keep the bags going as long as possible without falling, an object at first difficult of attainment, but which with practice becomes comparatively easy.

BATTLEDORE AND SHUTTLECOCK.

This is a game indulged in by adults as well as by the youngsters, but although a capital game, in that it affords good exercise and amusement, it is not so popular as once it was.

Ordinarily, battledores are either made entirely of wood, or else with wooden handles and "drum"-heads of parchment (A). A more expensive kind of battle-

dore is made of boxwood for handle, with a strained net, like the bat used in lawn tennis (B). Either of the first two may be purchased for a small sum at any toy-shop, and they will be found much better than home-made battledores. The shuttlecock also is better bought than made; it consists mainly of a bit of cork, in which

goose-feathers of equal size have been stuck obliquely (C). The object of the game when played by one player is, after having thrown the shuttlecock into the air, to keep it bounding and rebounding as long as possible by repeated strokes of the bat end of the battledore. It will be found that the shuttlecock ascends and descends with the feathers downwards and upwards respectively. When more than one player indulges in the game, the players should be stationed at equal distances round the ground, each armed with a battledore, and by the aid of the battledores a shuttlecock, or more than one if it is desired, should be kept passing round and round.

BATTLEDORES AND
SHUTTLECOCK.

CHUCKS.

See "Pebble Game."

DIBS.

The game of Dibs, or Knuckle Bones, is played with five small bones, one of which is found at the knuckle end of every leg of mutton. These bones are best for the purposes of the game if obtained after the meat has been cooked and cut away. The order of the tricks varies considerably, and to give a complete list

covering all variations would be well-nigh impossible. The following, however, seem to be those most generally adopted, and it is open for any players to arrange variations on the tricks here enumerated :—

1. Begin by throwing up the five dibs and catching them, or as many as possible, first on the back, and then, by a rapid turn, in the palm of the hand. All five are seldom caught, but provided only one is caught play continues. Retain one of the caught dibs, and throw it up so as to be able during the time of its ascent and descent to pick up one of the dropped dibs. This continue until all the dropped dibs are picked up.

2. Scatter the dibs on the ground, lift one, throw it up, and before it falls pick up another, and with that still in hand catch the one just thrown up. Lay the first dib aside, throw up the one retained, pick up another and catch the one thrown, and proceed in this way until all are picked up. The first two stages are variations known as the "ones."

3. Scatter the dibs as before. Throw up one, pick up two, and catch the one as it falls. Repeat, and pick up the remaining two.

4. As before, but pick up three and then one.

5. As before, but pick up the four at once.

6. Take a dib in the palm of the hand, and hold one between the finger and thumb, throw up the latter, and before catching it place the other one on the ground. Immediately after, again throw up the caught dib, and pick up that placed on the ground before again catching. Repeat, increasing the number of dibs placed on the ground by one each time until four have been laid down and again picked up together in the same way.

7. Take up all the dibs in the hand, place down one dib, throw the remaining four into the air, lift up the one and catch the four as they fall. Repeat by increasing the number placed down one each time and decreasing those thrown by one until four are laid down and one thrown; the four being picked up after the one has been thrown into the air and before it is caught.

8. Take four dibs in the hand, and hold the fifth between the finger and thumb; throw that one up, drop one of the four out of your hand, and catch the dib thrown. Throw the same dib up again and drop another, so continuing until all four have been dropped. Then fling up the dib again and pick up the four before catching the thrown dib.

9. Place the left arm along the ground, and put one dib at the elbow and one at the finger tips. Then remove the arm, throw up a dib, pick up the two so placed and catch the dib. Repeat by placing one dib half way between the two on the ground, and pick up three; then place the four, two at each point, and pick up the four.

Other variations on these same stages may be introduced.

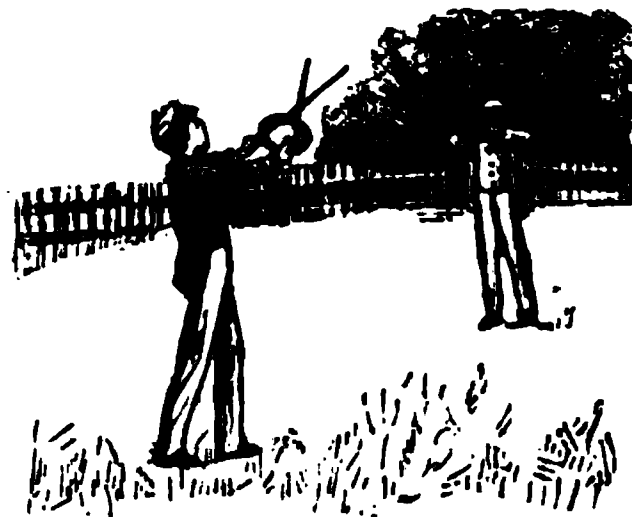
It is the general practice for the game to begin by one player taking the dibs and to commence the series, continuing until he fails to perform one of them; when the dibs are passed on to the next player. The second player then does the same, and so on until the dibs have passed again into the hands of the first player. He then recommences at that stage at which he previously failed, and continues or passes the bones on as before. The first to reach the end of the series wins.

GRACES.

This is a very similar, although much prettier game, than that of Bags.

Two players are each provided with a small hoop and two sticks, and the game is to throw the hoops from the sticks and to catch them again on the sticks in the same succession as the Bags are thrown and caught in the game of that name.

The hoops are also sometimes thrown from both sticks, as shown in the annexed illustration, and caught on one or both, according to the wish or ability of the players; the object being not to allow the hoops to fall to the ground. This game is sometimes called by its French name, *Les Grâces*.



GRACES.

JACKS.

See "Pebble Game."

JACK'S ALIVE.

This game is played with the orthodox cheese-shaped skittle-ball. The figure of Jack is usually made of some light but durable wood, with a weighted spherical base, so that he cannot be knocked over unless the figure is hit towards the top. Those hits only count in which the top of the figure is made to touch the ground. It is essential that the base of the figure be heavily weighted, but the spherical shape thereof may be dispensed with. This game is sometimes played with an ordinary smooth wooden ball, and a correspondingly small figure.

KNUCKLE BONES.

See "Dibs."

PEA-SHOOTER.

The Pea-shooter is a metal tube, through which a pea is propelled by a puff of the breath—or rather that is a description of the toy known as a pea-shooter. The boy owning the toy is the real pea-shooter; and, although he may get a lot of fun out of his toy, he is apt to be looked upon as a nuisance by other people, especially if he can aim straight, and does so when he fires at them.

PEBBLE GAME.

This is precisely similar to the game of Dibs, except that small smooth pebbles are used instead of knuckle bones. The description of the game of Dibs is entirely applicable to that of Pebble Game. The game when played with pebbles is also known as Chucks, Jacks, and occasionally, in Scotland, as Fives.

PITCH AND TOSS.

There is a variety of games with buttons known as Pitch and Toss. They are generally arranged in the same way as many of the marble games, although the number of the games played with buttons is not so great as that played with marbles. A reference to the Marble Games will show which of them can be readily adapted to games with buttons; it being understood that when marbles are shot, buttons must be pitched or tossed in the required direction.

POP-GUN.

The best of Pop-guns are home-made. Get a straight piece of even thickness out of an elder bush. The branches most suitable are those from about three-quarters of an inch to an inch in thickness; remove the pith from the inside, so as to form a hollow tube from end to end, and let the wood dry and harden. The ramrod should then be made of some hard wood, the handle of which is to be nearly as thick as the gun, but the ramrod must be evenly scraped until it is small enough to pass readily along the inside of the tube of the gun, and should be about half an inch short of the length of the gun. The pellets, for ammunition, are to be made of moistened paper, or, if it can be obtained, of tow moistened; they should be made to fit tightly into the opposite ends of the pop-gun, and, indeed, should be forced in with the ramrod. When a pellet has been securely placed at each end, the ramrod should then be taken, and with it the pellet at one end is to be forced through the gun, and it will then drive out the pellet at the opposite end with a loud pop and considerable violence.

Toy pop-guns may be purchased of various degrees of elegance; but for excellence, although some approach, none exceed that made at home out of a bit of an old elder stub.

RED, WHITE, AND BLUE.

This game consists in bowling a large and heavy ball at a distant object, in order to overthrow it. At the far end of an alley, or other piece of ground, should be set up three posts of wood, with a cube placed on the top of each. These cubes should be numbered 0 to 5, 1 to 6, and 4 to 9, respectively. Each player is entitled to bowl three balls at the objects so arranged, and he scores the number shown uppermost on the cubes that are displaced from the posts; the highest score wins. The posts and cubes are to be coloured red, white, and blue, or each of the posts and each of the cubes should be of one or other of these colours—hence the name of the game. This game may also be played with small as well as with large balls, posts, and cubes.

RING THE NAIL.

For this game a board is required into which are driven a number of short iron pegs or nails about two inches long; the centre peg, being about half an inch taller than the remainder, is called King. A number of small rings are then provided, and the play is to proceed to a certain distance from the board, and to throw the rings so that each will encircle a nail. Each successful throw counts five, but if the King is encircled that counts twenty. This game is also known as Skip.

SKIP.

See "Ring the Nail."

SKIP-JACK.

The Skip-Jack is best made of the forked bone, commonly called the "merrythought," of a fowl. The merrythought should be preserved whole, and a piece of catgut, or two strings twisted together, be tied round its two arms, a thin piece of stick being inserted in the middle and between the twisted strings; the stick ought to be just long enough to extend beyond the arch of the bone. If the strings have been sufficiently twisted it will be found that the stick placed between them will now act as a spring. The Skip-Jack is thus complete, and it will be made to skip by carrying out the following instructions. Push the stick up, so that its free end may rest under the merrythought, just where the stick touches the bone; apply a small bit of cobbler's-wax, so that the end of the stick may adhere to the bone; then place the toy on the ground, and in a few seconds the spring of the stick will have overcome the adhesion of the wax, it will get free, and the Jack will skip to a considerable height.

SQUIRT.

The Squirt consists of a tube, into which a piston or plug is so nicely fitted that no air can pass by its sides. To the piston a handle is attached, and at the far end of the tube from the handle there is a small opening. To play with this toy the piston has first to be pushed down to the bottom of the tube, the nose of the tube has to be just placed in water, and the piston then drawn up gradually. The piston thus acts as a pump and fills the tube with water, which is squirted out by forcing the piston again towards the nose of the tube. Malicious use is sometimes made of this toy, but we may as well say here that this book is not written for any boy who finds either pleasure or amusement in

squirting water over passers by or other persons, that is to say, who finds pleasure in making others uncomfortable.

STILTS.

This is a pastime consisting of mounting on two poles, and so walking or running. To make a pair of stilts two poles of equal length are to be obtained, and to them, at the desired height from the ground, should be nailed small steps or footrests, of sufficient size and strength to give the foot a firm hold, and to bear the weight of the body. The poles should be long enough for the person using them to hold the tops when standing on the rests, and when walking on them he must raise each stick alternately with the hands, lifting the foot at the same time and continuing the motion alternately with the respective legs and arms as in ordinary walking. Should he feel himself losing his balance, the best plan is to leap to the ground, and avoid as much as possible the risk of falling. After a few trials, stilt locomotion will be found to be very easy and enjoyable.

After practice has made boys perfect in the use of stilts of the above description, a more simple sort may be employed with due caution and care. Have the stilts made of poles, the tops of which, when the person using them is mounted, reach no higher than is necessary to secure them to the leg by means of a strap a little below the knee, and let the feet be strapped to the rests or steps. The walking on stilts of this description is precisely similar to ordinary walking, but to secure one's balance, and as a support when required, a long pole to be used as a walking-stick should be provided. Many feats may soon be attempted on stilts, and they will, as a rule, be found to be easy of accomplishment. Barring the risk of falls, it will be discovered that the higher the stilt-walker is raised from the ground the easier as well as the more rapid will be his progress, and a skilful stilt-walker will be able to cover a long distance of ground in a short time.

Stilts are not only used as toys, but in many countries from the nature of the ground are really serviceable in active life.

SUCKER.

A Sucker is made by cutting a circular piece out of a scrap of stout leather, boring a hole through its centre, and passing a string through the hole, with a knot at the end large enough to prevent it from slipping through. A piece of wood for a handle should be tied to the other end of the string. The Sucker is then complete, but before using it it should be well soaked in water, and while still wet and pliable the leather is to be placed on a stone, or other weight presenting a smooth surface, and pressed down until all the air between the leather of the Sucker and the stone or weight has been excluded. In attempting to lift the Sucker by the handle it will be found that the stone will adhere, and that considerable weights may be lifted by this means.

TIP-CAT.

The game of Cat, or Tip-Cat, is essentially a summer game; there is not sufficient exercise involved in playing it to recommend it as a winter pastime. The materials required are of the simplest kind, and may readily be made by any lad rejoicing in the possession of a good stout pocket knife. An ordinary stick, or piece of a broom handle, about eighteen inches or two feet long, and a "cat" of from three and a half to five inches long, are all that will be required. The "cat" may be cut out of any ordinary piece of wood; it should be of the length specified, and either round or square, from three-quarters of an inch to an inch and a quarter in thickness, and sharpened at both tips to the length of from an inch to an inch and a half, according to the size of the "cat" (see woodcut).

In many respects the game is similar to that of Rounders, and in others to that of Trap, Bat, and Ball, both of which are fully described in the section of "Ball Games." Indeed, if the principles laid down for the guidance of boys playing those games are mastered, the game of Tip-Cat, as described below, will be a very simple matter.

A small ring, called "home," about twelve or fifteen inches in diameter, is to be formed on the ground, and a line, called the "offing," drawn at a distance therefrom of four or five yards. The player who is "in" takes his position at "home," and is provided with a stick; the out-player, or one of them when there are two or more, takes his position at the offing, and takes temporary possession of the cat, which does service in this game as the ball does in the corresponding ball games.



THE "CAT."

It is the object of the out-player to so throw the cat as to lodge it within the circle forming home; but his opponent, the in-player, is allowed to protect the ring by striking at and hitting the cat with his stick after the cat has left the pitcher's hand and before it reaches the ground, and sending it as far away over and beyond the offing as possible. If, however, the cat falls within the ring the in-player is out, but if it falls outside the ring and without being struck, the in-player is entitled to three tips with tries at a hit, or to one actual hit to send it away from the "home." A tip consists in knocking the cat at one end so as to make it fly into the air, in the manner in which the ball is knocked from the trap in Trap, Bat, and Ball, and as the ball in that game so the cat in this may then be hit. If the pitcher delivers the cat so that it falls on the line forming the ring, the player is entitled to one tip only with a hit, or a try at a hit. When the cat has been hit away, the player names the number of paces that he considers the out-player (or any one of them when two or more) would take to cover the distance between the cat and the ring; and if the distance is not covered in the number of paces named, that number is counted towards game, and should be so scored. If, on the contrary, the player by an error of judgment names such a number of paces that in that number an out-player at the first attempt covers the distance, the player is out. Only one measurement is allowed. If after the hit or after the third tip, the cat remains within one pace of home, the player is out.

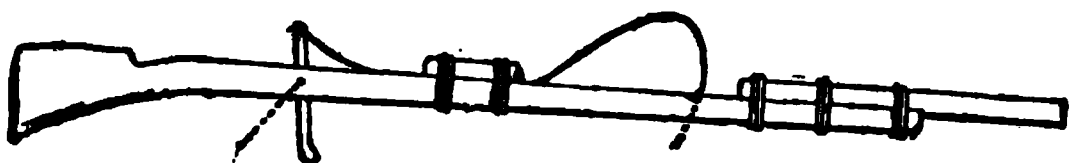
Tip-Cat, played as above, with sides of about six a-side, is the best form of the game; but as there are varieties of the ball games referred to, so there are of this, and it may be modified and simplified according to the whims or tastes of the players. When sides are playing, all the members of the out side scout, and may stop the cat as well and as often as they can, when outside the offing; if the cat is caught after a hit, not after a tip, the player striking it is out. If the cat is tipped or hit so that after the hit or after it has been tipped the proper number of times it remains within a distance that can be covered by one pace of any of the opposing side, the player is out. Players on the respective sides change places when all the side "in" have been made "out."

A "pace" is defined as the longest distance that is covered in any one leap, step, or jump. A number of paces must be taken running and consecutively, as in the step of "Hop, Step, and Jump," without making any rest or interval between any two paces. The last pace in a series may be a jump.

Tip-Cat, as played in the streets of our large towns, is a much simpler affair. The object then seems to be only to send the "cat" flying as far and as swiftly as possible, to the annoyance of foot-passengers and the danger of windows. It is certainly not a suitable game for the streets.

WATCH-SPRING GUN.

This toy may be made with the exercise of no very considerable amount of ingenuity (*see diagram*). Get a piece of wood several inches long, and cut it into the form of the stock of a gun. In the upper part of the stock, where



WATCH-SPRING GUN.

the barrel lies in the ordinary weapon, scoop out a groove, and in this groove place a large quill open at both ends, and fasten the quill to the gun-stock with waxed thread. One end

of the quill should project beyond the muzzle end of the stock, and the other should reach towards the middle of it. Next obtain a piece of old watch-spring, about the same length as the quill, bend it backwards, and then tie one end of it firmly to the upper part of the butt-end of the stock. Through the stock, about half an inch from the mouth of the quill, bore a small hole, break a pin in halves, take the top half, and round the pin's head tie a piece of thread, fasten the other end of the thread to the string that binds on the spring; the gun is then complete.

To fire the gun place a shot between the hole in the stock and the lower mouth of the quill, put the pin in the hole, bend back the spring, and let its loose end be caught by the pin; then take aim, draw out the pin, and let the watch-spring free. The action of the spring will send the shot through the quill a considerable distance towards the object aimed at. Or the gun may be fired by pulling a trigger to which one end of the watch-spring has been secured.

Our list of Minor Out-door Games is now exhausted; but before leaving it we would mention, that though there may be variations of the games described that have not been included, sufficient information as to the principles of the different games has been given to enable our young friends to make such variations as circumstances of locality and associates will render necessary. Many of the games here called out-door games may be so modified as to be adapted to in-doors, if desired; and, on the other hand, among the in-door games will be found others that can be indulged in out of doors. So far as the toy games are concerned, it should be a maxim never to buy a toy that can be made at home; and it will astonish many to find how soon, with the exercise of a little care and patience, a really capital set of toys may be turned out by an ingenious lad. Kites, as already explained in the section devoted thereto, are really best when home-made, besides affording an interesting occupation for long autumn and winter evenings. In the field and playground games boys are for the most part quite independent of toy accessories; but when indulging in those pastimes it is necessary to consider well the likings and dislikings of all, as, generally speaking, the more there are to join in any game the greater the fun, the greater the variety, and the greater the opportunity for the display of those qualities that enable us to know how to do the right thing at the right time.

LAWN GAMES.

ARCHERY.

THE fashion of sports changes; now croquet, and again lawn tennis, is all the rage, but still archery holds its own, and is generally combined with the game in vogue when country clubs are organised. And no one who has ever practised with the bow and arrow can wonder at this. Rifle-shooting is very interesting, and may be considered as of more practical value, but it is not nearly so exciting as a close match with the more primitive weapons; and it may be doubted whether it is as good practice for hand and eye. There is so much more that is purely mechanical in rifle-shooting—the object, the fore-sight, and the notch must be accurately aligned, and then the weapon has only to be held steady. There is no allowance for distance, the adjustment of the back-sight regulates that; and though the force of the wind must be taken into account, that is done by aiming at another part of the target, to right or left, than the spot it is intended to strike. So that a good rifle-shot is bound to miss a moving object, unless he is a good field-shot likewise, or else an archer; for in archery the eye must be fixed on the object shot at, and the hand and judgment learn to act instinctively, which is the grand secret of all superiority in sports and games. And this is why a good cricketer is also successful at billiards, shooting, tennis, or whatever else he takes up.

Archery used to be a branch of education. In the original deed for the regulation and endowment of Harrow School, dated 1590, it is directed: "You shall allow your child at all times bows, shafts, bow-strings, and bracer, to exercise shooting." In consequence of this clause, it was formerly the custom to hold an annual exhibition of archery, when the scholars contended for a silver arrow, the chosen competitors being attired in spangled dresses of white, green, or scarlet satin. Indeed, it was altogether a ceremonious affair, every hit being saluted with a concert of French hunting-horns, and the winner of the silver arrow carrying it home, followed by the whole school in procession, with music, &c., and a ball finishing the day.

Roving is to archery what skirmishing practice is to the rifleman. The competitors have no pre-arranged mark, but wander about and select any object which it takes their fancy at the moment to aim at: a tree, a patch in a paling, or a notice-board threatening trespassers with the utmost rigour of the law. But a great drawback to roving is the loss of arrows, which renders it a somewhat expensive amusement to those who are not able or willing to manufacture their own.

Flight Shooting is simply seeing how far you can send an arrow, and is therefore rather a trial of strength than skill, and not to be compared for interest with aiming at a mark.

A work by Mr. Hansard contains certain suggestions for the commencement of practising with the bow which are very thorough, and, if carried out to the letter, would surely make an archer of any one who was not physically incapacitated in some way.

"The first distance," he says, "should not exceed ten yards; at which, after a month's diligent practice, he will be able to strike a tennis ball suspended from a string many successive times. Let him then remove it to twenty yards; and

on acquiring a similar degree of dexterity at that distance, his next step will be the extreme point-blank range of his bow."

The same instructor likewise advocates shooting at lanterns, after dusk, as the best method of learning to shoot straight, and consoles any ardent Toxophilite, whose enforced residence in town interferes with his practice, with the hint that the gas-lamp opposite his sitting-room is an excellent target: "I do not mean that he is to shoot at it," he hastens to add, "for merely to elevate his arms in the attitude of drawing a bow will assuredly produce the same effect;" which is almost too confident an assertion, perhaps.

A correct eye, strong arms, and a good position, will enable the archer to shoot straight, but keeping a length is only to be acquired by constant practice. The point-blank range of a bow and arrow is so very short that in target shooting you are never within it, but always have to shoot upwards, so as to pitch the arrow on the target, as it were, and the farther you are from the mark the higher, of course, you must shoot, till you reach the angle of forty-five degrees, beyond which the arc described by the flight of the arrow will be shortened instead of lengthened. Archers sometimes endeavour to find the proper elevation for sixty or a hundred yards by making marks on the glove of the bow-hand, but the best authorities are agreed that all such attempts are futile, and that sighting must be left to the rifleman. It is well that this should be the case: archery is a trial of skill, and the interest would be greatly diminished if the principal difficulty could be evaded by a mechanical contrivance.

The effect of the wind upon an arrow is very great. When it is a side wind you must allow for it in a lateral direction; when an up or down wind the elevation must be modified.

Should the arrow fall off the bow while you are in the act of drawing, it counts as a shot if it is beyond the reach of your bow: otherwise not.

Target Shooting.—A pair of targets are set up opposite to one another, at sixty, eighty, or one hundred yards' distance, and the party (eight being the largest number usually allotted to one pair) take their stand immediately in front of one, and shoot at the other till the number of arrows agreed upon has been expended. When the "end" is over, they all march in a row across the ground, and proceed to gather up their misses and extract their hits, the marker scoring each arrow as it is drawn out. Then they shoot in a similar manner at the other target, this time in order of merit, the most successful taking the lead, and the lowest scorer shooting last.

No arrow in the target should be scored unless it be marked legibly with the name of the owner.

The score is thus reckoned:—Gold, nine; red, seven; inner white, five; black, three; outer white, one. An arrow touching two circles counts for the highest. The highest score gains the prize; but no prize should be awarded unless twelve ends, at least, of three arrows each, shall have been shot; twelve double ends being the desired number, time and weather permitting.

Yew, lancewood, and hickory are the ordinary materials of which bows are made.

When taking up archery do not give too high a price for a first bow, since, if you keep up your practice, you will soon want a second and a stronger one. Of course, a practical trial will be necessary to enable the novice to determine what weight of pull best suits him, but the adept can make his selection without leaving the shop, the strength of every bow being tested in this way: it is strung, and balanced at the handle on some fulcrum, and then weights are hung from the exact centre of the string until it is stretched as far as it would be by drawing an arrow to the head, and the number of pounds' weight then suspended determines its power, and this is marked upon the weapon, which may be a

twenty-five, a seventy, or one hundred pound bow. It is from five to six feet long, thickest in the middle, which is termed the handle, and tapering towards the ends, which are tipped with horn, the upper being the longer. The notches for the string in these tips are called "nocks." The outer and flat side of a bow is termed the back, and the rounded inner side the belly. The handle is covered with velvet, worsted lace, silk, or leather.

When not in use the bow should be kept in a green baize bag, and if you entertain that feeling towards it which a good workman generally has for his tool, you will polish it up occasionally, by rubbing it first with oil, and then with French polish.

The strength of the bow must, of course, be proportioned to that of the archer. Lads who have not come to their full size or strength should use ladies' bows, which are from twenty-five to forty pounds in strength. A man of ordinary muscular development, however, should not begin with one of less than fifty pounds, nor rest contented until he can draw a seventy-five pound bow with ease. But if he commenced practice with a bow too strong for him, he would not be able to shoot straight. When there is anything of effort or struggle in drawing the arrow, the target will remain untouched.

Bow-strings are made of hemp. The string is fixed to the lower and shorter horn by a timber hitch, the eye having been previously slipped over the other end, so as to play freely up and down; but to prevent its slipping down too far when the bow is unstrung, it is well to loop the eye to the upper horn with a piece of ribbon. It is thought well by some to entwine both the eye (or upper loop, which you find ready made) and the lower noose (which you form yourself) with fine kid. Of more importance is it to mark that part of the string which strikes the arm when the arrow is released, and wind silk, slightly cobbler's-waxed, round it; for if the string becomes frayed it is liable to snap, and the consequent jar will often break the bow. Rather less than half an inch in the exact middle should be wound with silk of a different colour, to mark the nocking point. Whenever the string gets soft, and the strands loose, twist it tight again and rub it with white wax.

The distance between the belly of the braced bow and the string is called the shaftment, and should be about six inches. The old way of measuring is as good as any, which is to rest the clenched hand with the thumb upon the inside of the handle, and if the thumb-nail touches the string you need not alter it.

It is a great mistake in archery to have arrows too long. For a five feet ten bow a twenty-seven inch arrow is quite sufficient; a lady's bow, which is a foot shorter, should not shoot arrows that are any longer than two feet.

In withdrawing an arrow from the target or the ground, seize it close to the head, and turn it round with a boring motion as you pull. Careless handling is apt to injure the feathers and bend or break the shaft. Precaution is particularly necessary when the arrow is snaked—an appropriate term, signifying the course it sometimes takes through grass when the ground is so hard that the point glides instead of penetrating. A snaked arrow is often lost altogether, or only found warped and spoiled weeks afterwards, though the searcher may know almost the exact spot where it alighted, but when found, it is better to cut the grass on each side with a knife than to use force for its extraction.

Arrows are made of lancewood, lime, ash, deal, and poplar, and of these deal is most in requisition, fletchers preferring that found in old houses to new timber. A piece of heavier wood is generally spliced on to the deal at the point end, and this improves the flight. The points are of iron or brass, riveted on. The notch for the string is mostly of horn. The feathering is very important, as unfledged arrows will not fly true. The three feathers are of the goose or

turkey, and sometimes of the peacock—the one standing up when the arrow is nocked upon the string is termed the cock-feather, and is generally coloured differently from the others, to enable you to fit the arrow readily in the proper manner.

Archers who are fond of roving—as wander-
ing about shooting at any mark which takes the

fancy at the moment is termed—will often lose shafts, and will therefore grudge employing the expensive arrows provided for ordinary target shooting. If they will provide themselves with a stock of small iron heads, they may make very tolerable rough arrows out of straight unbarked hazel wands. The feathers should be attached (the bark having been scraped from the parts where they are to lie) by a mixture of isinglass and glue, dissolved in brandy; it will aid the operation if they are first dipped in hot water to soften them. Arrows should always be marked in some way to prevent disputes at the target.

Fig. 1.—THE BRACER.

Fig. 2.—THE SHOOT-
ING-GLOVE.

The Quiver is a green tin case for keeping arrows in.

The Belt is worn round the waist, and carries the arrows in use, a pot of grease, composed of beeswax and suet, and a tassel to wipe dirt off the arrows.

The Bracer (Fig. 1) is a leather guard for the left arm, buckled on to that part where the string strikes it when loosened, a very necessary protection.

The Shooting-Glove (Fig. 2) is composed of three finger-ends of thin leather, kept in their place by strips branching from a broader part, which is strapped round the right wrist.

A target card is almost invariably carried at archery meetings, the ladies wearing it suspended from the waist, the men from a button-hole. On it the scores of the competitors are marked with pin pricks, the columns being coloured in correspondence with the target—a gold hit scoring nine; a red seven; inner white five; black three; and outer white one.

TARGET CARD.

Archer's Name.	Gold.	Red.	Inner White.	Black.	Outer White.	No. of Hits.	Value
A							
B							
C							
D							
E							
Total hits and Value							

If an arrow sticks on the margin line of the gold, say, it does not score a gold if there is any trace of the red paint upon it. The same rule applies to the other

circles. Targets (Fig. 3) are of comparatively modern invention. In the palmy days of archery a white mark (the "clout") was fixed in the centre of the butt by a wooden peg, from which the marker measured to the arrow. To split this peg

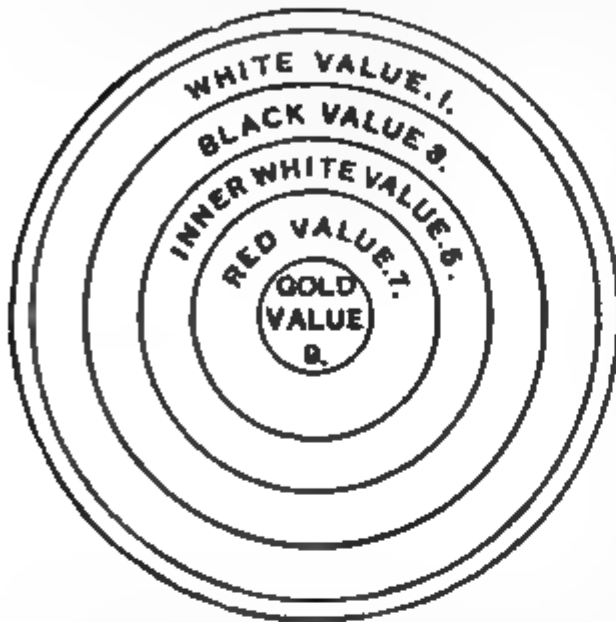


Fig. 3.—THE TARGET.

itself was the very perfection of shooting. The modern target is a flat circle of straw covered with painted canvas, the centre a circular patch of gilt, seven inches across, then a circle of red, and another of white, each three inches and a half broad, then a circle of black, one inch and a half, and an outer one of white, one inch broad. The target varies in size according to its distance from the archer. At one hundred yards it should be four feet in diameter; at eighty yards three feet; at sixty yards two feet.

The target is fixed on a triangle of wood or iron, so contrived that it may be elevated or depressed, as the shots are more or less remote.

STRINGING THE BOW (FIG. 4).

Hold the handle in your right hand, with the back of the bow towards you. Place the bottom horn against the hollow of the right foot, turning the latter so as to secure it, the left foot being advanced. Place the palm of your left hand upon the upper end of the bow, taking the eye of the string between the finger and thumb, and slide it up towards the notch as you push with the left hand, and pull with the right till the string is in the notch. Make sure that it is firmly there, and not awry, before you let go. Some archers use the left hand to pull at the handle with, and push the top of the bow with the right; it is the same thing.

Unstringing is performed in a similar manner. If the weather is cold, warm the bow before bracing it.

The above is the correct and graceful method of bracing the bow, but if it is a very powerful one, you may not be able to put it in practice. Then you must use your knee as a fulcrum, placing the bow across it with the lower horn in the ground, and the rounded inner side towards you, and pulling the top down with the left hand, while you nock the string with the right.

Or you may adopt the fashion of a certain tribe of Indians, who lie on their backs, take an end of the bow in each hand, and push the centre out with their feet, while a friend fixes the string. But the position can hardly be a graceful one.

Fig. 4.—STRINGING THE BOW.

Do not keep your bow strung longer than is necessary. When you have shot

your turn, unstring it at once, if several minutes are likely to elapse before you will use it again. A bow kept braced too long together is apt after a time to acquire a bend, or, as it is termed, to follow the string; and this detracts from its strength.

THE FIVE POINTS OF ARCHERY.

Ascham's famous five points are—standing, nocking, drawing, holding, and loosing.

Standing (Fig. 5).—Present your left side to the target, the face over the left shoulder, head and neck inclined slightly forward, for if you stand too stiffly erect, you will never acquire the "laying of the body in the bow." The feet are to be firmly planted upon the ground, with the weight of the body resting equally on both; the heels six inches apart. Ascham arrives at the correct attitude by the exhaustive process of pointing out all the faults which are most common. "Some shooteth his head out, as though he would bite the mark; another stareth with his eyes, as though they shulde fly out; another wynketh with one eye, and looketh with the other . . . ; another holdeth his neck awrye . . . ; another maketh a wringinge with his back, as though a man pynched him behynde; another cowereth down, as though he would shoot at crows; another setteth forward his left leg, and draweth backe with heade and shoulders, as though he pouled at a rope."

Nocking.—"To nock well," says Ascham, "is the easiest point of all, and therein is no art, but only constant attention to nock truly, not setting the shaft either too high or too low, but exactly straight across the bow. Inconstant nocking makes a man lose his strength; and besides, if the shaft hand is high and the bow hand low, or the contrary, both the bow is in danger of breaking, and the shaft, if it is small, will start; if great, it will hobble. You must always nock the cock-feather upwards; and be sure the string does not slip out of the nock, for then all is in danger of breaking." Be careful before nocking to see that the bow is not reversed, but that you have got the top uppermost; otherwise the coloured silk which marks the nocking point will be in the wrong place, and the arrow will not be drawn in the bow's centre. While fixing the arrow, pass the forefinger of the hand holding the bow over it, to keep it steady, and mind not to ruffle the feathers. The position is secured by placing the first and second fingers of the right hand close on either side of the nock, and holding it and the string by about the middle of the first joints.

Drawing.—In nocking, the bow may be held obliquely, to prevent the arrow falling away from it, but it must be raised to the perpendicular as you shoot. Raise your arms steadily, thrusting your left hand forward with your whole strength, while you draw the arrow to your ear with the right, till the pile (or head) of the arrow reaches the knuckle of the bow-hand. No matter whether it is for a near or a distant shot, the arrow must be drawn to the pile. Many archers

Fig. 5.—STANDING

draw to the breast, but that is bad form, giving considerably less power over the bow. There is another fault, which Ascham points out. Sometimes an archer, he says, "draweth his shaft well, untyll within two fingers of the head, and then he stayeth a little, to looke at hys mark, and that done, pouleth it up to the head, and lowseth; which way, though some excellent shooters do use, yet surely it is a fault, and good men's faults are not to be followed."

After you have once commenced to draw, never look again at your hand or arrow; keep your eye intently fixed upon the gold, to the exclusion of every other object, until the shaft is sped.

Holding.—Bowmen generally draw with three fingers, and the glove is made with three stalls to that intent, but many only use two. Anyhow, the arrow must be held between the ends and the first joints of the first and second fingers. "Holding must not be long," says Ascham, "after the bow is drawn up, for it puts a bow in danger of breaking, and also spoils the shot. It must occupy so little time that it may be perceived better in the mind when it is done, than seen with the eye, when doing."

Loosing.—This, says Ascham, "must be performed much in the same manner as holding. So quick and hard, that it may be without any twitches; so soft and gentle, that the shaft fly not as if it was sent from a bow-case. The mean betwixt both, which is perfect loosing, is not so hard to be followed in shooting, as it is to be described in teaching. For clean shooting, you must be careful of not hitting anything about you; and remember to hold your hand always the same height on your bow, that you may keep the length truly."

Doubtless this loosing of the arrow is the most difficult motion in shooting, principally in consequence of the necessity of wearing those clumsy finger-stalls; if you had a finger and thumb with pinch enough in them to draw the bow alone the matter would be easy enough. As it is, there is at first a difficulty, a hitch in letting the string slip at the critical moment, which is as great an impediment to making a good shot as a stiff trigger is in a rifle, or a hang-fire with a shot gun, and this is only to be got over with practice.

The bow-arm must be held as firm as a rock at the moment of loosing, for, unless the bow is held as in a vice, the flight of the arrow cannot be steady. All this must be done mechanically, however; you must not think of your arm or fingers, you must not be conscious that you have such things, even as the arrow flits away; your whole being should be concentrated in that bright patch in the centre of the distant target; for the fraction of a second you must be ignorant of the existence of anything in the universe but—a bull's-eye.

Holding, drawing, and loosing, though treated separately, for the purpose of explanation, form one continuous action, indeed, the archer should loose *while drawing*.

BADMINTON.

BADMINTON is a game which would perhaps never have attained to even what popularity it has if it had been compelled at its first introduction to compete with so powerful a rival as lawn tennis. It had the start of a year or two in the race—at least as far as England is concerned—and thus established some title to fame before the other was ever heard of as a popular game. In India it had a still greater advantage, and, like polo and some other games, was freely patronised in Calcutta and Madras long before the good folk at home had any idea that sport could be had out of it. The name is said to be derived from the place where it was invented by an ingenious amateur; but it will be obvious, from a description of the play, that it is in its principle of an older date than is usually assigned to it.

The game is, in fact, an adaptation of the ancient child's game of battledore and shuttlecock (Fig. 6). All that is added is a net which compels each player to return the shuttlecock fairly to his adversary, and so insures that when a stroke is missed the fault is with him who missed it, not with him who made the last stroke before, as was usually the case when the shuttlecock was allowed to be played without any limit as to height. The requisites for the game are, besides the net and poles, nothing more than a few good shuttlecocks, and as many battledores as there are players. The framework of the battledores should be covered in with string, like a racquet, and not with parchment, so as not to make that loud noise which is one of the disadvantages—or perhaps, to some juvenile players, the attractions—of the more boyish game. The shuttlecocks should be large and solid, made of cork weighted with lead, and having a thread passed round the feathers, crossing them alternately in and out, and drawn tighter or looser according as it is wished that the shuttlecock should go more or less quickly through the air.

The rules for Badminton are no more than an adaptation of those in use for lawn tennis; and, indeed, with the exception of the fact that a shuttlecock is used instead of a ball, and that all the strokes must be played at the volley, there is little real difference in principle to be traced between the two games. The court for Badminton need not, however, and should not, be nearly so large as for the other game. Forty-two feet long and twenty feet wide is the usual size, but it may be enlarged if big and swift-flying shuttlecocks are used. Another peculiarity is the rule as to service and the service line.

FIG. 6.—PLAYING BADMINTON

This line is placed at various distances from the net, according to the strength of the bats or racquets used, but it is seldom more than nine or less than five feet from the net. The service must in this game be sent *beyond* and not on the inner side of the service line; that is to say, it must be so delivered that if the adverse player does not touch it, it falls in the court beyond the service line. If he does touch it, no matter where it may be going, it cannot be counted a fault, but must be returned properly, as if it had been rightly served; for it would of course be out of the power of any umpire to say whether if not touched it would have fallen in or outside the court. There is yet one more point of difference between badminton and lawn tennis; and that is the rule that in the former the net must be five feet high at its lowest part. The scoring may be arranged either as at tennis or as at racquets; that is to say, the games may consist of forty-five or of fifteen: but the former is much the more convenient plan, and, in any case, the constant changing of courts and of services between one side and the other should be avoided as a waste of time and trouble.

The chief defect from which Badminton suffers, and which has robbed it of some of its popularity, is the great effect which a high wind, or indeed any wind at all, has on the shuttlecock. On a great many days in the year it would from this cause be impossible to play out-of-doors; and a match which had been arranged

between two players, or two clubs, would thus have to be put off altogether, or played under conditions which would reduce it to little more than a contest of chance and luck. Of course, if there is a hall or room large enough for the purpose this objection does not hold good; and these are the places where it is best to set up the nets. As an in-door game for rainy weather nothing can be better than Badminton; and it makes quite as good an exercise for winter as for summer days, as it is capable of being played by artificial light whenever there are means of lighting the room well from above. When it is played out of doors, and there is a wind, it will be best, perhaps, to arrange for the net to be in a line with the wind, so that each side suffers equally from the sidelong action of the air. If it is impossible to do this, and the wind must needs be at the back of one party and in the face of the other, some compensation may be made by moving the net a foot or two up wind, so that the service line is only four to seven feet from the net on the windward side, and six to eleven feet off on the leeward. It is also a good plan to shorten considerably the length of the courts on the leeward, so as to make it more difficult for those playing on the advantageous side, up wind, to place their shuttlecock within bounds, and at the same time more easy for the others to return it in the face of the wind. It is to be feared, however, that, no matter what precautions are taken, each side will soon get tired of playing in a really strong breeze, and that the game, with all its merits, which are considerable, must be reserved for still days and for in-door use. It may be added, however, that when a spare room can be found, having pretty smooth walls, without too many corners and angles, Badminton may be played with much pleasure even in a very small space. A room from sixteen to thirty feet long, and from eight to twenty feet wide, is not too small for the purpose. A net may be stretched across the middle of it, and the shuttlecock, even if it does strike against the side or back walls, will bound off quite far enough to allow of its being struck by the battledore, and thus the game comes to include in itself some of the charms and difficulties of racquets, and to be, in the opinion of some players, rather improved than spoilt by the limitation of space. Badminton is sometimes played across a long room or court, broadwise instead of longwise, three or even four players being ranged on each side, and the shuttlecock being sent obliquely in all directions, to any one of the party, each of whom has a separate portion of territory to defend. The game may also be varied by setting up two shuttlecocks at once, and serving one at the same time from each end of the line of players. These are modifications which certainly add an interest to the amusement, and they may be supplemented by others invented, as occasion arises, by the ingenious mind.

BOWLS.

THIS game is, no doubt, of immense antiquity; and it was for several centuries, at least in England, held in fully as high estimation as its venerable age deserved. As early as the time of Edward II. we have representations of courtiers and men of fashion playing Bowls; while in the days of Elizabeth no country house of any pretensions was ever without its bowling-green, and no assemblage of country gentlemen was ever held in summer without an adjournment to this part of the grounds for a game. A century ago it still held its ground manfully, and it is only within the present century that it began to lose favour, and give place to more exciting and laborious pastimes. There may still be seen in the colleges

at Oxford and Cambridge, and also in some of our finest country houses, the carefully-levelled and very smooth-turfed lawn, which was once used as a green, but has since been devoted to such unclassical games as croquet, badminton, and lawn tennis, or, more often still, reserved jealously for purely ornamental purposes. It is astonishing with what diligence and care in those days the best bowling-greens were prepared. Nothing like so great attention is now generally paid to a cricket-ground, the grass on which must always be considerably worn away in the course of each season's play, whereas the even surface of a good bowling-green remained uninjured year after year, and became the very model and pattern of a perfect lawn. In Scotland the game still holds its own, and there the greens, as a rule, could not be improved upon.

The game itself, although it appears at first sight one of the simplest imaginable, is not by any means so easy to understand as many others in which the apparatus used is more complicated. It may seem to those who first see a game played that it is little more than marbles on a very large scale. But if they listen to the conversation of the players, they will find that the terms used are decidedly difficult of comprehension; and if they attend to the score, they will find that there are plenty of rules and restrictions. It is in the course of centuries, during which Bowls was the most respectable of all out-door games, that these terms and laws were devised; and they show to what refinement a game most simple in its origin can be brought by the artifice of man.

The requisites for the game are, first, the "green," the extent of which should not be less than thirty yards long and thirty yards wide. These limits, however, represent a small green, and a lawn of sixty yards square would more nearly approach the *beau idéal*. Secondly, there must be twice as many bowls as there are players, and a "jack" for each set which it is intended to play. The bowls are made of lignum vitæ, and are of a very peculiar shape, between that of an orange and that of an egg. There is a very marked difference between the bowls used on English and Scottish greens, and on many grounds south of the Tweed there may frequently be seen in the same game, or match, bowls manufactured in both countries. The contrast in the build and run of the bowls is remarkable, and points to the superiority of the Scottish turnery. It was at one time common to make the bowls exactly like flat oranges, or even sometimes like globes, and then to load one side of them by inserting a piece of lead, which was, as it were, imbedded in the wood at one end of the axis. But the same object—that of causing the bowl to swerve in its course towards one side—is now effected by the turner, and the use of lead would not now be countenanced by a scientific maker of bowls. This tendency to swerve to one side is called the *bias*, and it is most noticeable when the bowl is going slowly, just before it comes to a standstill. It is at this moment that it seems to curl round in a curious way; and it is here—in a practical knowledge of the effect of the bias—that the difficulty and the merit of the game at once consist.

The jack is a much smaller ball, quite spherical in shape, and made either of wood, or, more often, of earthenware. It is used as the mark at which the bowls are played, and is first bowled out by one of the players to a spot on the green, and then aimed at successively by all the players, whose endeavour it is to make their bowls rest as near to it as possible. This bowling out of the jack is called "setting a mark;" and in order for a mark to be properly set, it must go at least twenty-one yards from the place at which it is delivered, and stop not less than three feet from the edge of the green; but in some clubs no such hard and fast rule exists. The place from which it and the bowls are played is called the "footer," where a piece of carpet or waxcloth is spread for the players to stand on as they deliver their bowls. The following are other terms used in the game: A "cast," or point, is like an "ace" at racquets—a unit made in the score; and

the "set," or game, consists of as many casts as may have been agreed upon. A bowl is said to be "dead" when it has been illegally played, or if it has been played or knocked off the green. Of course, if it has been played strongly, and runs into the ditch, it is dead. Dead bowls ought immediately to be removed from the ground. An "end" is a complete round, in which all the

players have delivered their bowls. It is called a "void" end when neither side is entitled to score a cast. The measuring is an important element in the game, for it is often impossible to judge by the eye which bowl of two is nearer to the jack. The question, whenever it arises and cannot be settled by agreement, is decided by the use either of the "standard," which is a small light rod, sometimes made of straw, or by means of two pegs having

Fig. 7. - DELIVERING THE BOWL.

a cord made fast at one end to one of them and running through a hole in the other, or (failing either of the foregoing appliances) by a piece of string or a foot-rule. The measure is taken from the nearest part of the jack to the nearest part of the claimant's bowl, and the bowl to be first measured is that of the party which at the time is leading in the game. A bowl is said to "rub" or "set" when in rolling it strikes against anything which throws it out of its course.

These being the principal terms specially used in this game, it remains to explain the method of playing, and the rules most usually recognised. After the sides have been chosen, or it has been agreed, as it often is, to play all against all, the pairs of bowls, distinguished by being marked on the wood with figures, letters, pips, or other devices, are handed to the respective players, and that one of them who is to lead off takes up the jack, and, standing on the footer sets the mark for the first set. He follows this up by delivering his first bowl (Fig. 7), rolling it in such a direction, and with such force, as to allow it to come to rest as close as possible to the jack. He is followed alternately by the players on each side, who all deliver their first bowl, and then the series recommences in the same order until all the second bowls are played. Or, where sides are chosen, opponents play off in pairs; thus, A sends down his first bowl, B, his adversary, follows suit; then A sends down his second bowl, and B does likewise. They are followed by C and D, and so on. Eight players, four aside, make a good game. If the leader fails to set a mark properly, by either sending it too far or not far enough, and repeats this failure twice, it then devolves upon one of the opposite side to exercise the privilege. The leader does not, however, on this account lose his right of playing first. If a player play with his opponent's bowl, the opponent has the option either of taking it up and substituting his own bowl in the place to which he had played the wrong one, or he may, if he prefer it, go on and play with his defaulting opponent's bowl. This is a somewhat harsh rule; and it is obviously very necessary for the earlier players

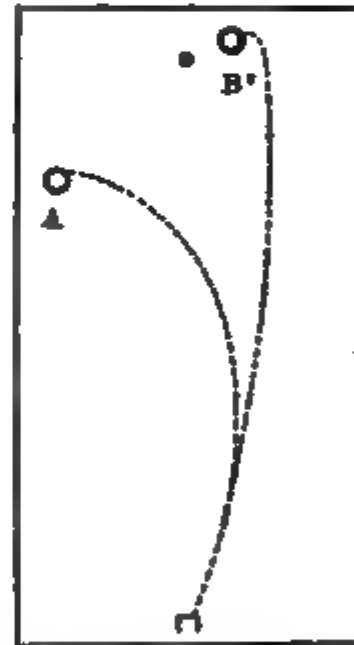


Fig. 8. - NARROW (A) AND WIDE (B) BOWL.

to take particular care that they pick up the bowls rightly belonging to them at the conclusion of each end, as otherwise a great advantage remains to their adversaries whose place it is to play after them. It is not lawful to play any bowl before the one previously delivered has stopped rolling; and the penalty for this is also very severe, as the bowl so prematurely played counts as a "dead" bowl. The same punishment is incurred if a player touch one of the rolling bowls belonging to him or any one on his side; but if one of the players should stop or touch an opponent's bowl before it gets as far as the jack, then the player shall have the privilege of placing the bowl in question at whatever spot he pleases. When the bowls rub or set one against another and yet remain on the green, they are to be left wherever they go to, and the measurement taken accordingly; but if the jack is knocked off the green the end is a "void end," and, as we have already seen, if a bowl is in fair play knocked off the green it instantly becomes dead. However, on some grounds the rule is in force that when the jack has been knocked off the green, it must be laid down at the point where it left the grass, the game afterwards proceeding as usual. If a rolling bowl, after it has gone more than two yards past the level of the jack, rub or set upon anybody or anything not engaged in the set, it also becomes dead.

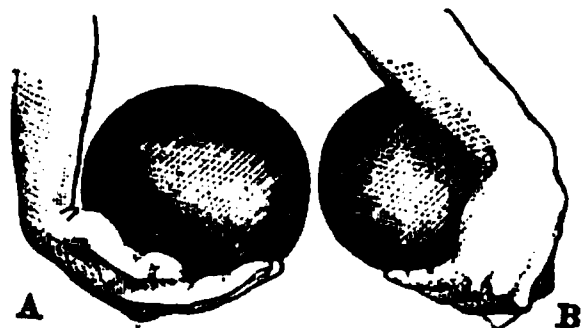


Fig. 9.—FORE (A) HAND AND BACK (B) HAND DELIVERY.

Nevertheless, it is really impossible to give a cast-iron description of a game at bowls, for the practice—especially in England—is not absolutely the same on any two grounds. It is much to be desired that uniformity of play should be generally adopted throughout England, as is the case in Scotland to a very large extent. In fact, if the play of both countries could be assimilated in accordance, for example, with the rules issued by Mr. T. Taylor, of Montrose Street, Glasgow, this reform would be entirely to the advantage of the game, which is not only one of the most health-giving games, but the out-door game that involves the highest degree of skill. Fortunately there has been a decided revival of Bowls, and it says much for the new spirit of play that its tendency is to play more according to the rigour of the game, and to accept in a sportsmanlike spirit the rubbers which those who play at bowls must expect.

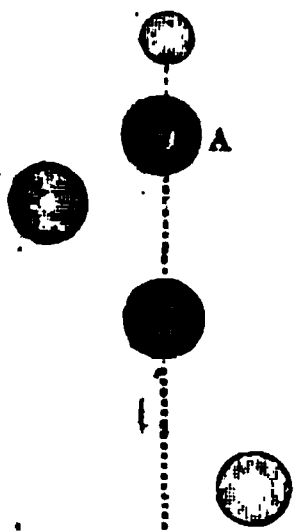


Fig. 10.—BLOCKED BOWL (A).

Accidental displacements of a bowl are remedied by replacing it by consent as nearly as possible to the place where it was; but if the bowl is displaced by a player before the ball is at rest, the adversary is entitled to play it over again. A player who allows the bowl to slip from his hand as he delivers it may take it back and try again if it has not gone farther than he can reach with his hand while keeping his foot on the footer. In delivering the bowl, it will partly depend upon the position of the bowls already played, and partly upon the advice offered to you by your captain, whether you should play always "fore"-hand, or sometimes "back"-hand, that is, with the right hand or left hand bias (Fig. 9). Amongst the devices resorted to in play one of the most important is that of "blocking"—that is to say, stopping the road towards the jack by interposing a bowl. Whenever the leader has made a very good stroke, and left his bowl quite close to the jack, this stratagem is often resorted to by his partner, for the purpose of preventing the subsequent players on the other side from displacing it or the jack (Fig. 10). But it is a rule that for the purpose of so blocking the way the bowl must be fairly rolled,

and not "placed" with the hand. and, moreover, that it must go at least as far as three yards from the footer, a rule which seems to make the other, as to placing, unnecessary. Partners are permitted to advise one another, but are absolutely prohibited from explaining the lie of the opponent's bowls which they have observed by walking up to the jack, and also from holding a conspicuous mark between the jack and the player to guide him as to the direction in which he shall play. This is a very important rule, as after the first player on each side has played, he often goes to the end at which the jack is, and remains there for the express purpose of advising his own side; and on grounds where each player is allowed to play his two bowls consecutively it is still more important, as the foremost player, having once delivered the bowls, remains at the other end till the set is finished.

When the end is played out, the measurements are taken, as already described; and it then becomes the privilege of the player who played last to place the footer, which he should do near the place where the jack was last laid. The leader has the right, if dissatisfied, to take up the footer, and place it anywhere within a yard of the spot where the jack was. If the jack has been knocked off the green, the footer should be placed a yard from the precise place where it went off. The loser in any game is entitled to lead in the next; and the winner or loser of each end is entitled to lead the next, as may be agreed upon or prescribed by the regulations in use on the ground.

It will be seen, from the minuteness of the above rules (which are only a selection from a large code), how much attention has been paid to the ancient game now under consideration. As we have seen, in point of skill Bowls possesses all the attributes of a most scientific pastime, and it is one which is capable of indefinite improvement as long as ever the player chooses to continue his practice at it.

CROQUET.

NEVER, probably, has there been a game so universally and thoroughly popular in Great Britain as Croquet, and never was a popularity so rapidly achieved or so soon undermined and thrown into the shade when its zenith had once been reached. Those who remember the first introduction of the game can alone recall to mind the sort of mania which it excited throughout the length and breadth of the land. It was the first successful attempt that had been made to invent an out-door game in which both sexes could join on terms of equality, in which both old and young could take part with equal chances, and in which, as scarcely any muscular power was required, the weak stood almost as fair a chance of winning as the strong. These various advantages, both physical and social, acted with the greater force upon public opinion, inasmuch as the rage for athletics of all kinds was then reaching its height amongst boys and men, and it was natural that girls and women—to say nothing of children—should feel a desire to excel also in some sort of out-door competition.

Croquet, then, in its origin and early history, is entitled to be numbered amongst the numerous athletic games which have been introduced with so much energy and with such immense benefit during the last thirty years. It was productive of what may be almost called a revolution in the social life of the country; for from the time of its recognition as a national game, garden parties, which had hitherto been very dull and monotonous affairs, became the most common and popular of all entertainments in country places; and an amount of

out-door exercise—not violent, or even active, it is true, but still very beneficial—was secured to hundreds of thousands who, but for the attractions of Croquet, would have remained in-doors poring over some occupation which could have done them, physically speaking, no good at all. Another advantage which Croquet secured for us was the conversion of numerous lawns and gardens into excellent smooth plots of turf, available not only for Croquet, but afterwards for the more manly and exciting game of Lawn Tennis, which may now be said to have succeeded to Croquet in the popular estimation.

The merits of Croquet in its social aspect must always remain unquestioned, whatever may be its ultimate fate as a pastime or competition. But the more sober and humble objects of its inventors, whose ambition was, probably, merely that of amusing, were in the course of time to a great extent superseded by the efforts of enthusiastic players to make the game a trial of skill. With this object clubs were started, very much on the system of the old Archery clubs; and prizes were offered to be played for in the most serious and determined style. Instead of practising for the mere pleasure of distinguishing themselves on a lawn or beating a rival in fair field, these zealots began to cultivate the art and science of Croquet with a view to more solid advantages. The rewards obtainable by first-rate performers ceased to be merely the admiration of an assembled company and the envy of less skilful players, and began to consist of gold ornaments, silver-mounted croquet mallets, opera-glasses, and a whole host of congruous or incongruous prizes, paid for by the entrance-fees or presented by some enthusiastic patron of the new game. Such an altered state of things involved, of course, the drawing up of strict rules, and the enforcement of them by umpires, committees, and other competent authorities. Meetings had to be held to draw up codes of rules, and a vast amount of debate and discussion—to give it no harder name—ensued before it was found possible to establish laws in which every one could acquiesce. Then came the establishment of national clubs and the organisation of national prize meetings, with fifty-guinea challenge prizes; and Croquet began to look as if it had taken its place as a permanently favourite sport of the English people, rivalling in its own way such things as boating, cricket, archery, and the like.

We may now, at this distance of time, at once confess that these ideas were extravagant and mistaken. As a social amusement Croquet was, and still is, a great success. But as a game of skill, and a subject of serious competition, it has been proved a failure. No one now hears much of All England Croquet meetings; and if there are such things no one goes far to look on. As an art and science Croquet is capable of almost endless elaboration, and becomes a field for the exercise of much ingenuity, much tact and nerve, and considerable muscular strength. But in proportion as it thus advances to perfection it becomes more and more wearisome and dull. To watch a first-rate player plodding on through a long break is an intolerably tedious task, though it is hardly less so than the task of the performer himself. In a word, patience was found to be in the advanced stages of the game a more important qualification than any amount of skill; and a sport which depends upon such a principle could never long retain a leading position as a game for every class. Something more lively and affording more scope for activity was imperatively needed by all able-bodied persons; and this we soon found in the shape of Lawn Tennis. What wonder, therefore, that the latter should have advanced with giant strides since its introduction, and that the former should have fallen farther and farther into the background?

It would, however, be a complete mistake to suppose that Croquet will ever be entirely superseded and discarded. The more active game will, perhaps, always be more popular amongst the more agile class of persons, whatever may be their age. But it would be a great error to suppose that every one is at every

time full of this restless energy. There are, unfortunately, many men and many boys who are not physically robust enough to indulge in violent exercise; and there will be times when even the most energetic have need of a more gentle style of amusement. Take the case, for example, of those who are recovering from a fever or long illness, and who are too weak to be excited or over-fatigued, but may, at the same time, be largely benefited by quiet exercise in the open air. Croquet is the thing of all others at such moments; and those who do at such times, or at any other, from one cause or another, indulge in the amusement, may as well in that, as in everything else, strive to do it with all their might, and in the best possible fashion. An acquaintance with the laws and practice of the once popular game will never come amiss; and, moreover, there is scope in it for the acquisition of a great deal of really useful knowledge relating to angles, strength of hitting, pace, and the measurement of distances by the eye. It will be well if, in our remarks upon the game, we describe first of all the original and most simple form of it, which may be called the social game of Croquet, and then proceed to make some observations on it in its more scientific aspect.

In its primary and simplest shape, Croquet was played with eight or a less number of balls, and as many mallets, ten hoops, and two pegs. The pegs were small posts of wood hammered into the ground, so as to leave about eighteen inches of them above it, and round this projecting part were often painted successive rings corresponding with the colours of the balls. For instance: pink at the top, and below it black; then yellow, and next blue; and so on, a dark colour always alternating with a light, whatever might be the order in other respects. Corresponding with the colours on the posts were the colours of the eight balls themselves, which were originally painted all over, so as to resemble the balls used in playing pool on a billiard table. They were of tolerably hard wood, and of a size ranging from hardly more than that of a cricket-ball to twice or even three times as big. When the sides were chosen, the four, or three, or two players on one side selected each their own one of the light-coloured balls, and their opponents in a similar way portioned out those of the darker hue. The hoops were formed of pieces of stout wire, and their width was apt to be altered to suit the fancy of the players; but the space between the two sides of the hoop was originally from about eight inches to a foot. The primitive mallets were rather flimsy affairs, about five or six inches in the length of the head, with a circumference of eight or ten inches, and having a handle about three feet long.

If the game was a single game—that is to say, if there was only one player on each side—it was usual, or rather invariable, that he should take two balls, and by, as it were, dividing himself between the two, make the game equivalent to one of two on each side; he might, indeed, take three, or even four, and thus imitate the full game as played by eight persons. If there were three, or five, or seven players, one of those on the minority side was allowed two balls, and so the match was readily equalised; and, indeed, there was no disadvantage at all in thus playing single-handed against any number of opponents, provided the balls used on each side were equal in number.

The arrangement of the ground was the following, variable, however, according as the lawn to be played upon was of larger or smaller extent. Supposing it to be forty yards long and thirty yards wide, the pegs would be set up at the two ends of the ground fifteen yards from each side and about four yards from the extreme edge on the top and bottom. Four yards from the peg at the bottom of the ground, and exactly in a line between it and the other peg, was hoop No. 1, fixed cross-wise in the ground, so as to directly face the two pegs; and four yards farther on in the same line was the second hoop, similarly arranged. At the other end of the ground nearest the top peg, and four yards from it, was hoop No. 7, set up in

precisely the same way; and four yards from it, again, stood No. 6. The other six hoops were ranged along the sides of the ground, three on each side, two of them being exactly half-way down the ground, and thus half-way also between the level of the two pegs, and the other two on each side being respectively four yards behind and in front of those last mentioned. This row of three hoops on each side was posted five yards from the edge of the ground, so that there would, of course, be just twenty yards between them, measuring across the centre of the ground. The three hoops on the left-hand side looking up the ground were numbered 3, 4, and 5, and the others on the right-hand side were 12, 11, and 10. This setting will appear more clearly by reference to the diagram (Fig. 11). Let us now describe the progress of a game under these conditions played in the old style, which is now coming rather commonly into fashion again.

The first player, who, we will suppose, has a pink ball, sets it down at a starting-place about half-way between the peg and the first hoop. He hits it gently through that hoop, and then, having by virtue of that achievement secured the right to a second turn, through the second hoop. Having got thus far by means of two easy strokes, he finds a more difficult one awaiting him. Hoop No. 3 does not lie in a straight line in front of him, but obliquely to the left. It stands at such an angle to him, that he can only by the most accurate aim induce

his ball to go through. The deviation of an inch to right or left will make him miss, and accordingly the chances are greatly against his being able to advance any farther. If he does make a good shot and get through, he has then a much easier task before him in passing hoops 4 and 5. No. 6 is again a very difficult one, but still it is practicable; and he may, after passing it, go straight on through No. 7. It is then necessary for him to make his ball hit the post, and after doing so to commence his homeward journey, travelling successively through No. 7 (which now counts No. 8), No. 6 (now No. 9), No. 10, No. 11, No. 12, and so on to No. 2 (now 13), No. 1 (now 14), and back to the starting-peg. When he has hit this he has done all that is required of him, and is out of the game; and in a single game, when each player had one ball only, the performance of such a feat (which was just possible under the old rules) would, of course, win the game right off. Practically speaking, however, no one ever did thus make a tour of the ground without the aid of another ball. He was always arrested in his course by one of the difficult corner strokes, even if he were clever enough to miss none of the easier hoops.

The second player, who follows with the black ball, has a very different game to play, and a much better chance of getting on. Supposing that he passes the first hoop successfully, and so becomes entitled to another turn. He may then at any time, instead of aiming at a hoop (or as well as aiming at a hoop), aim at the ball of his adversary the first player, wherever it may be. And if he hits it, he has this privilege: he may take up his own ball and place it side by side with the other, on whichever side he chooses. He may then hit his own ball in whatever direction he likes, and if in moving his own ball he also moves the other, even an inch or the fraction of an inch, he has then got another stroke at his own ball, wherever it may be. It is manifest that the advantages to be got out of this

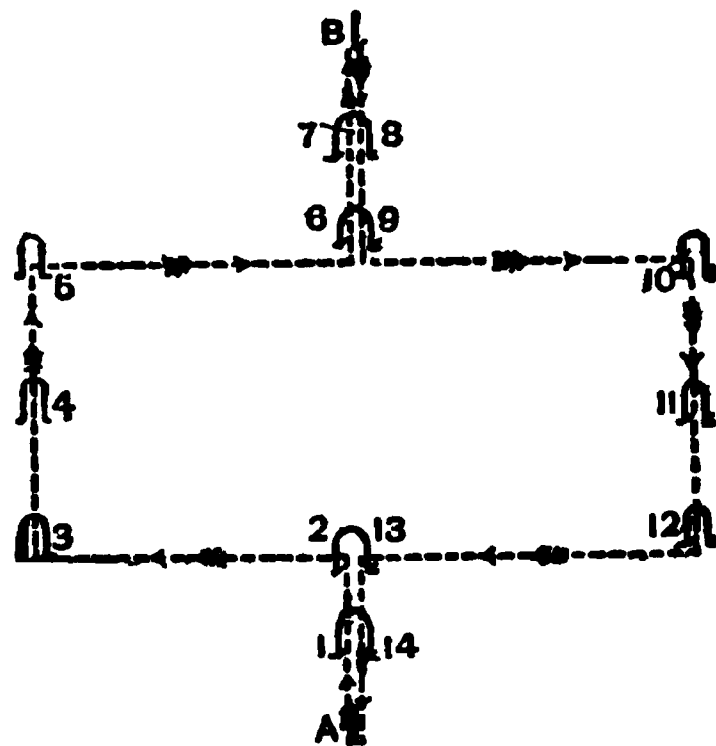


FIG. 11.—SETTING OF THE HOOPS IN THE ORIGINAL GAME OF CROQUET.

proceeding, which is called "croquetting," and which is, of course, the distinctive feature in the game, are invaluable and almost endless. By a clever stroke the adversary may, in the first place, be sent flying out of position to a remote and unfriendly corner of the ground. The player's own ball may, at the same time, and by the self-same hit, be sent into position, where, by the other stroke to which he is entitled, he can go through his hoop, and so acquire the right of again aiming at the unfortunate adversary.

The second player has, then, a better chance than the first, inasmuch as, instead of being confined to his own unaided exertions in striking his ball through each hoop in succession, he has another ball to "play upon," and if he can hit it may utilise it once and again in securing for himself what amounts virtually to a series of double strokes. The third player is still better off, as he has two balls to play on; and so on in proportion to the size of the party, the last player in an eight game having a choice of no less than seven balls at which he may aim directly he is in play and each time he has passed a hoop, or, as the term is, has "made a point."

It was some years before Croquet players thoroughly understood what a vast deal could be done by a skilful person in utilising the services of another ball by this process of croquetting. When they had mastered it at last, they soon showed by their performance in matches that the whole secret of success lay in an application of the process to every stage of the game. When once a ball had been hit, or to speak technically "roquetted," by a player with his own, his cue was not to send it flying off to a distance, but with a much more refined cruelty to use it, if it were an enemy, as an assistance in getting through his own hoops. By a gentle and apparently most amiable hit the captive ball was sent on a short distance ahead, there to await the coming of the persecutor after he had passed his next hoop. When that had been safely done, the captive was quietly roquetted again, and again sent on into position to await the making of another point. This was the course pursued with an adversary, taking care that, while every convenient use was made of him, he should never be "put through" one of his own hoops in order, and never left in such a position as he might, when released, turn to advantage.

As for the ball belonging to a friend, it might, of course, also be utilised in a precisely similar way, with the exception that, whenever an opportunity occurred of helping him, by putting him through a hoop or "pegging" him, by striking him against the peg, it was, of course, taken by the player, who also, as soon as he had done with its services, was always careful to leave the friend's ball in a good position for his next stroke.

As soon as these principles were understood Croquet made an immense stride forward in the public estimation. It was seen to be not only a social but a sociable game—a game in which devotion to friends was as conspicuous and necessary as hostility to foes. Alliances were made between the better players on each side for the support of the weaker, or by the weaker players on one side for a general attack upon the best player on the other. Such a development of Croquet involved, however, some disadvantages with its many advantages. Games of eight, or even six, were often found to be interminable, and whole afternoons were spent without either side being able to overcome the powerful combinations made against it by the cunning adversary. Another result was that the original setting was found too simple for the good players. When the task of running through the fourteen hoops in order became one of little difficulty, which on a good lawn, with improved materials, was soon the case, the victory resolved itself pretty much into a question who should make the first roquet and so getting "in," as it was called, make the winning "break." With a single ball to help him—and still more assuredly if he had two in tow—a tolerable player ought to make absolutely sure of scoring his fourteen points in

succession; when, by sending off the adversaries' balls to a distance, and leaving his own and his partner's together, he gave the latter an almost certain opportunity of repeating the performance, and thus scoring a victory before, perhaps, the other side had had a single reasonable chance of a break.

In order to provide a remedy for this state of things two devices naturally presented themselves—that of decreasing the size of the hoops so as to make it more difficult to run through them, and that of altering the position of them so that it should be more difficult after passing each one of them to proceed into position for the next. Accordingly, a great variety of alterations were suggested in the arrangement of the hoops, one of the best and most generally adopted of which is represented in Fig. 12. It will be seen that in this setting the hoops are very much more difficult to pass than in the original plan, and that, in fact, it would be absurd to even attempt to pass from one to another of them without the assistance of a captive ball. Secondly, the size, or rather the width of the hoops, has been reduced to an extraordinary extent. At the first great tournament or champion prize meeting held at the Crystal Palace in 1868, the space between the two sides of each hoop was 6 inches, and this was reduced in subsequent years to 5, 4, and even on one or two occasions to $3\frac{1}{2}$ inches, the balls used being at the same time $3\frac{1}{2}$ inches in diameter, so that it might almost be said that the deviation of a hair's breadth in accuracy of aim was fatal to all chance of making a point. A more reasonable and convenient width is about 5 inches, which for all practical purposes, and for the general average even of good players, makes the game quite difficult enough.

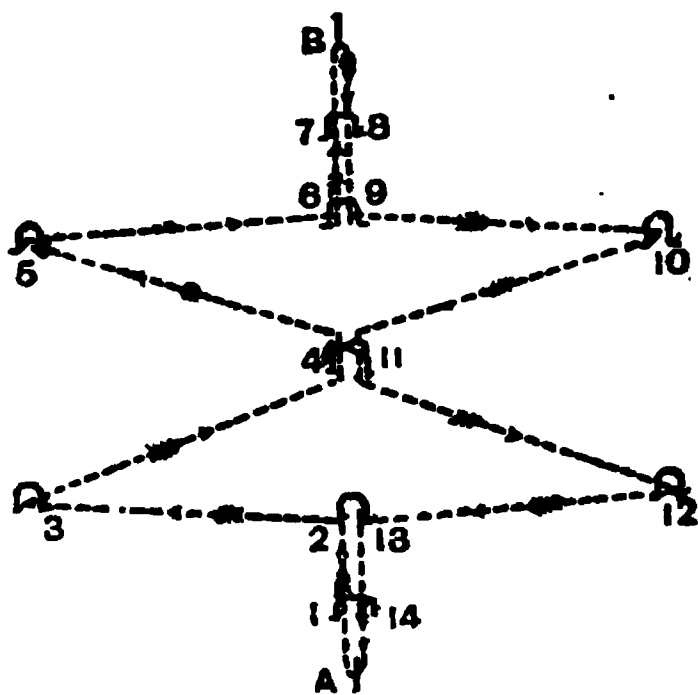


Fig. 12.—A LATER SETTING OF THE HOOPS IN CROQUET.

Besides the terms which have been already explained, the following seem to need some sort of definition:—

A ball is said to be *in hand*, after a roquet has been made and until croquet has been taken.

A ball is said to be *a rover*, when it has made all the necessary points but one, i.e., after it has passed through all the hoops, and hit the stick opposite to the starting-post; if it hits the other stick, it is *dead*, and can take no more part in the game.

Finesse is strategic management of your ball, by which you apparently waste a turn or two in order to hamper your adversary's play, and secure some future advantage.

Position is the best place suited for enabling you to pass through a hoop in the right direction.

The following terms refer to the use of the mallet:—



Fig. 13.—THE "RUSH."

The *Rush* is hitting a ball very hard, so as to drive it forward to a place from which croquet may be most advantageously taken. For instance, in Fig. 13, if A had to pass through hoop 3 in the direction indicated by the arrow, it would be best to "rush" B, if so placed, to point 2, from which croquet might easily be taken into position. The term "drive" has been suggested as better and more expressive than "rush."

The *Cut* is really the *rush* made under very difficult conditions. It has exactly the same meaning as in billiards, viz., hitting a ball very fine in order to make it travel to the side instead of forwards. For instance, if A wanted to pass through hoop 4 in the direction indicated by the arrow, it would be best to cut B to position. (See Fig. 14.)

The *Split* is a stroke used when you desire in taking croquet to move both balls some

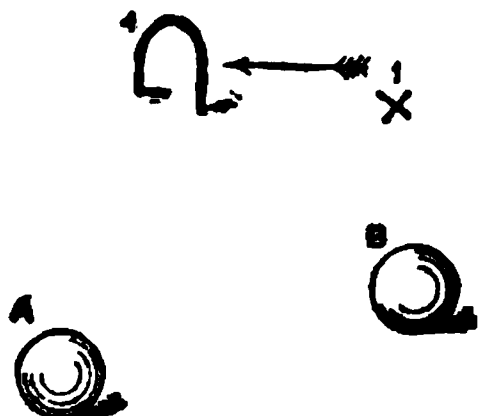


Fig. 14.—THE "CUT."

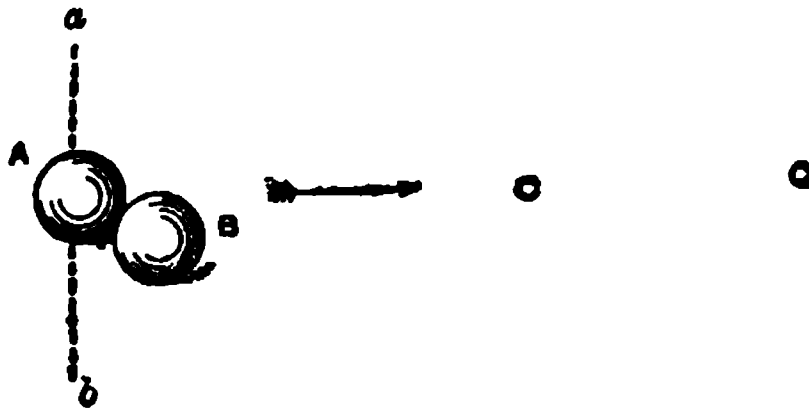


Fig. 15.—THE "SPLIT."

distance: the position of your own ball determines whether they shall both go equally far, or whether one shall go farther than the other. (Fig. 15.)

The terms "thick" and "thin" are applied peculiarly to this stroke. If you roquet a ball near its side you are said to be laying the ball "thin," if near the middle, to be laying it "thick."

The *Roll* is a stroke used to propel both balls about the same distance.

The *Pass* is a very difficult application of the roll. It is used to roll your own ball much farther than that from which you are taking croquet. (Fig. 16.)

The *Stop* is a stroke resembling as far as is possible in croquet the billiard screw. It is impossible to attain in croquet to that tremendous power of screw which is practicable on a



X 6

Fig. 16.—THE "PASS."

billiard table. Yet for all this, it is in the power of an experienced player to effect a stroke which savours of a screw, by hitting his own ball as low as possible and full in the centre, with a kind of check of the mallet handle at the moment that it strikes the ball. (Fig. 17.)

"Dead and live ball" are terms applied to the adversary's balls in reference to the sequence of their play; the ball that has been played just *previous* to your turn being called the "dead" ball, as it cannot play again till you have had a turn with both balls, and hence, at present, it may be used by you as an inanimate enemy. The ball that will play immediately *after* your *present* turn is called the "live" ball, and must be treated with caution, as being alive to avail itself of any slip of yours.

A player is said to have "*command of the balls*" when he has made a hit and got all the balls into favourable positions; and he is said to retain that command as long as he continues his turn or leaves the balls well placed for his next ball. The object of *finesse* is mainly to prevent a player obtaining this command.

A player is said to "*get the rush*" on a ball when he so places his own ball as to be able to rush the other to the desired spot. He is said to "*give the rush*" when he either places his partner, so



X 1

X 2

Fig. 17.—THE "STOP."

that it can rush some ball favourably next turn, or else places some ball in front of his partner, so that it can be favourably "rushed" by the partner.

A player is said to "*pass the break*" to his partner when, after making a break, he leaves the balls so that his partner can avail himself of them to make another break.

You are said to "*play into your enemy's game*" when you strike your ball into that part of the ground where it will be placed favourably for the play of your opponent with his next ball. Players who know little of the game are perpetually doing this, as they think that

the main object of the game is to shoot at some ball, forgetting that, if they miss, their ball is going into a position advantageous to their adversary's play.

A ball is said to be "*wired*," either when it is placed so that a wire intervenes between it and the ball to be hit, or when it has been driven close against a wire, so as to make it impossible for it to be struck in any direction except sideways from the hoop.

A ball is said to be "*stuck*," or "*sticked*," when one of the sticks takes the place of a hoop in hampering its play.

A player is said to "*lay up*" near a hoop or a ball, when he ends his turn by placing his ball there.

To return to the balls and mallets, the reason for treating them first is this: that it is well for any young player, and even for those who are climbing the ladder of success, to appreciate that a great deal is to be done towards attaining to good play with the mallet and balls alone, even if there be not a single hoop within a thousand miles. It must be remembered that though the main object of the game is to pass through hoops, position cannot be gained to pass through a number of these hoops consecutively, or even through one alone, without careful management of the balls. Now this is impossible without an accurate knowledge of the force you are applying with the mallet, the relative speed of the ball over the grass when it is dry or wet, short or long, and the various angles at which the balls divide.

To acquire the exactness necessary for the game, one should always use a mallet of the same weight and height, which should be proportioned according to the strength and stature of the player. If the mallet is too long or too heavy, it catches the ground, or drives the balls too hard in delicate strokes; if it is too short, or too light, it is apt to hit the ball on the top and make it hop, or it does not give sufficient force.

The first advance in the shape of mallets is to be attributed to private enterprise. Most of the manufacturers were, and still are, very loth to fall in with the new conception of a mallet, as the increase of wood needed to make eight mallets is considerable; and the mallets which are often sent out in the ordinary croquet-box are still inadequate, compared with the average match-mallet and putting aside the more ponderous weapons.

In 1869, a great advance was supposed to have been made on the toy mallets, and those used in most of the public tournaments were six inches long and two inches and three-quarters in diameter, weighing about 1 lb. 12 oz. There were mallets heavier than these then existent, some being used at the Crystal Palace tournament in 1868; but the figures given represent the average.

In 1872 the mallets used in public tournaments varied in weight from 2½ lbs. to 3½ lbs., their length being from seven inches to nine inches, and their diameter fully three inches. The increase in weight is to be partly attributed to the use of plates, which will be now explained.

Some players, notably Mr. Peel, the then champion, finding that the stroke which has been described as the "*rush*" was difficult to achieve without striking your own ball too high, and thus making it hop over the other, conceived the idea of cutting away the bottom of the mallet, which was thus able to be swung nearer to the ground, so that the striking centre struck the ball very low, and made it go forward steadily. In many other strokes, too, it diminished the chances of the mallet catching the ground.

This kind of mallet was adopted by the majority of croquet players, and many supplemented the change by "*plating*" their mallets, i.e., by having a brass plate screwed upon the flat bottom.

Of course this made the mallet considerably heavier, and, in the opinion of its advocates, rendered many strokes easy of execution which were very difficult with light implements. There can be no doubt that less exertion is needed with a heavy mallet, and so a lady who aspires to excellence in match play will probably do well to use one; but given strong wrist-power and fairly muscular arms, it

becomes a question whether the additional weight does not make the mallet too unwieldy, and incapable of very delicate play. No one, however, can be dogmatic on this point, for it is a matter of private taste, and each player had better choose the weight which suits him best, and make himself master of its peculiarities.

We have had mallets with looking-glasses fitted in them, in which the ball aimed at was to be reflected; mallets with black lines drawn along them, which were to guide the eye unerringly; mallets with long handles; mallets with short handles, sometimes heavily weighted with lead; mallets, also, with one end of the head more heavily weighted than the other; and innumerable shapes and sizes of heads; but all former peculiarities had to bow before the combined oddities of a mallet which once graced the Wimbledon lawn.

The head of the mallet was a large square slab of wood, octagon-shaped at the top and sliced at the bottom; but the handle which was inserted in it was the great curiosity. It was shaped at the top like a spade-handle, and the shaft was bound tightly round with leather and whipcord, in order to insure a firm hold and deaden vibration. But there was additional provision made against vibration being felt at the moment of striking by the manner in which the handle was inserted into the mallet-head. The wood shaft came to an end, and then two pieces of thin iron, quite separate, were the connecting link between the handle and the mallet-head. The owner of this machine, when about to strike, grasped the spade with his left hand, with his knuckles turned towards the striking end, and steadied the handle by laying hold of the whipcord. It required a most inelegant attitude to perform properly with it, as the player had to stoop completely over the ball, and turn his head askew to take aim.

There are various means for insuring a firm grasp of the handle. Some cover it with leather, but this gets slippery in wet weather; others bind it with whipcord, which is liable to blister the hands; others use the octagon-shaped handle, which is supposed to keep the head of the mallet pointed true; others cut notches in the wood; and we all know the familiar rings turned in the handles of the croquet-box mallet. The head of the mallet is made best of box, as it drives well when seasoned properly, and is not so liable to chip at the rim as *lignum vitæ*. Ivory mallets are simply expensive toys, as they chip frightfully.

There remains a very important point to notice—the way to grasp the handle so as to insure good play. Here the words of Lauthier serve admirably as a general principle.

“The hands ought not to be either too close to one another or too far apart; the arms neither too stiff nor too extended, but easy, so that the stroke may be free and unconstrained. The left hand, which is uppermost, ought to have the thumb opposite the middle of the mallet-head, and the thumb of the right should cross a little obliquely over to the tips of the fingers, because if in raising the mallet we do not keep the thumb so crossed, the mallet swerves in falling on the ball. The right hand must therefore hold the mallet as tennis players hold the racquet, for the thumb so clenched with the tip of the fingers is much firmer, and better directs the stroke to where one wishes to go, and gives more strength and ease to the wrist, which ought to work with freedom.”

It is the right hand which does the main share of the work. The left hand steadies the mallet when great force is used, and the right hand directs the application of that force by the firm grip which the clenched thumb gives. It is difficult to state any precise rule as to what distance from the mallet-head the hands should be placed.

A few words are now required on the way of holding the mallets for the peculiar strokes we have described. In order to make a “rush” the mallet must be grasped very firmly, and swung rather more from the shoulders than the wrists: that is to say, there must be little elbow work, else the ball will be hit too high, and jump

over that which it is intended to drive forward. It is best for this stroke to have your ball as nearly as possible midway between your feet, so that the mallet may be swung like a pendulum, and, as it were, pick up the ball in the middle of its swing, when it is at its nearest point to the ground. It is for getting underneath the ball, in order to insure its travelling, that the slice is chiefly useful. Let the beginner attempt this stroke first at very short distances, and then gradually increase the interval.

The "cut" requires a quick eye rather than any particular hold of the mallet. For the "split," "roll," and "pass," the mallet-handle must be "gripped" very tightly in all cases, but the method of applying force is quite different; for in the "split" there must be almost always a sharp crisp blow; in the "roll" a heavy pressing stroke, with the whole weight of the body put into it; in the "pass" a pressing stroke, with the addition of wrist action, only to be learnt by actual instruction from a proficient. In the "stop" stroke the handle ought not to be grasped too tightly—just as in billiards the cue is held rather loosely for screwing—but the fingers must be clenched enough to make the mallet hit the ball full in the centre, or the stroke will be a failure. Let the mallet be under-sized and have a green-heart handle. Dogmatism on the subject of mallets is certainly to be deprecated, but a practical recommendation seems necessary for beginners, so we will leave them to test our recommendations with a sliced mallet of about 2½ lbs., with a head of boxwood, and an octagon handle of good ash.

There is a limit to the size of proper croquet-balls; and they are not, like the mallets, at the mercy of individual performers. The diameter should be 3½ inches; and if any player should find that the circumference of his balls is more or less than 11½ inches, he should at once discard them, as useless for all purposes of practising for match play. He should also ascertain that they do not weigh less than fourteen ounces. Elm and box are the chief woods used for making balls; the latter is very preferable, as being less liable to chip, and heavier, so as to travel more steadily across the lawn and over the inequalities of the turf. This latter is really the best feature of the heavy balls, as the light ones, if struck sharply, jump and hop over others, so as to try one's patience sorely.

There are two ways of painting balls: first with stripes, secondly with whole colours—that is to say, the balls are sometimes partially painted with one, two, three, or four stripes of one colour, so as to distinguish them from each other, the space not occupied by the stripes being merely varnished; sometimes they are painted all over with different colours, the latter being preferable, as it preserves the balls more effectually, and presents a better object to aim at, while the stripes on the strikers' balls often puzzle the eye, if they lie diagonally to the line of aim.

It is best, too, to have netting round the lawn, and thus prevent the balls continually going off it, and getting dented or otherwise injured.

Lest it should be thought that the narrowing of the hoops is due to the fancy of a few proficients, it may be well to note two performances which show how completely the wide hoops had been mastered.

At the Crystal Palace, in 1868, Mr. Hale went fourteen times round the old ten-hoop setting with six-inch hoops, and at Aldershot in 1871, a break of one hundred and thirty-seven points, *i.e.*, ten times round all but two hoops, was made for the break prize with 4½-inch hoops.

Hoops should be of half-inch iron, their width being regulated according to the advice already tendered. The crown of the hoop should be at least twelve inches clear of the ground. It will be found best for many reasons to have the crown of the hoop at right angles to the legs.

Hoops are useful, not only for balls to pass through, but also for punishing adversaries; as there is no more hopeless position for a striker's ball than rammed tight against a wire, or placed so that the hoop effectually prevents the mallet from

striking the ball. Such a ball is much more safely disposed of than if it were at the bottom of the lawn, as in the latter case a fluky shot may turn the tables. In the former, any shot at all is almost impossible. It rewards any player to practise constantly the wiring of an adversary's ball.

There is a standard way of ascertaining whether a ball has really passed through a hoop. If there is any doubt as to whether a ball is through, apply the following test:—

First, set the hoop upright, then pass a mallet-head down the legs of the hoop, on the side from which the ball was played; then if the mallet-head reach the ground without touching the ball, the ball is through the hoop; but if it even graze the ball, the hoop must be passed again. The ball, however, is deemed "in position" for that hoop, and need not be struck back before going through at the next stroke.

Connected with hoops are certain appendages called "clips," which are used to indicate the state of the game, both to the players themselves, and to the bystanders. They are painted with discs coloured like the balls, and are fixed on the various hoops or sticks for which the different balls are destined. Croquet players are indebted to the inventor of the clip for a veritable olive-branch of peace. The prevention of incessant wrangling about the right hoop will atone for a multitude of his sins.

The two pegs which mark the turning and the winning points should not be less than one inch and a half in diameter, and they should stand at least eighteen inches above the ground. They should be made of springy wood, so that the balls may easily bound back; and a short wooden crossbar should be driven through the top of them, to furnish a holding place for the "clips."

The following are the distances between the hoops, as arranged in the chief settings:—Pegs are in the centre of the ground, seven yards and a half from the nearest boundary, and the hoops up the centre of the grounds are five yards apart, and the two middle ones two yards off the centre line; the corner hoops are about six yards from centre, and lie in a line with the pegs. Starting point about two feet from first hoop, straight in front. In the six hoop setting the pegs are in the centre line of the ground, eight yards from the nearest boundary; hoops up the centre line, eight yards apart; corner hoops, seven yards from centre, and in a line with pegs. Starting spot, one foot from left-hand corner hoop, and opposite its centre.

The laws of croquet were first drawn up at a general conference of croquet clubs in January, 1870, and a revising committee of leading players and supporters of the game amended them in 1871 and 1872, any important alterations being only made after the opinions of the secretaries of local clubs had been ascertained.

They are the following:—

1.—There is no restriction as to the size of the mallet nor as to the place where the handle may be grasped; but the handle must not be used like a billiard cue; nor the side of the mallet head, except in cases where the striking is impeded.

[The latter part of this rule "bars" two strokes known as the cue stroke and the mace stroke.]

2.—The player who wins the toss has the choice of balls and of commencing the game. The game is begun as soon as a ball is struck from the starting-point; such ball being in play whether it passes the first hoop or not.

3.—No ball can be roquetted twice consecutively without a point having been made in the interval.

4.—If the striker's ball touch another at the beginning of a turn, a roquet is supposed to have been already made.

[Herein croquet differs from billiards, where touching balls prevent scoring.]

5.—If a ball pass through a hoop and roquet a ball lying beyond in the same stroke both the point and the roquet are made; but if a ball pass through a hoop after a roquet the point is not made, as a ball is in hand after a roquet.

6.—A ball sent off the ground is brought out at right angles to the boundary line and three feet from the spot where it crossed the line.

7.—A ball lying within *less* than three feet of the boundary *must* be brought out three feet, unless it is that of the striker, who has the option of bringing it out, or playing it where it is.

8.—Croquet *must* be taken from a ball which has been roquetted either by simply "taking off" or by a splitting, rolling, or stop stroke. The striker is *not* allowed to place his foot on his ball.

9.—If in *taking croquet* the player causes either of the balls to cross the boundary, the turn *ceases*, and the balls remain as they are; that sent off the ground being replaced (according to Rule 6); this latter ball being said to be "killed."

[This rule is called the Dead Boundary Rule, and was first framed by the Fourshire Club, to whom a great debt is due for it. Its introduction quite revolutionised the tactics of the game, and made judgment of strength the *sine quâ non* for a good player.]

10.—A player makes *foul strokes* when he

- (a) Hits another ball besides his own;
- (b) Makes an inaudible stroke, *alias* "spoon";
- (c) Hits his own ball twice, *i.e.*, by following on with his mallet;
- (d) Allows any ball, when *in play*, to touch any part of his person;
- (e) Lets a ball rebound from a wire or stick upon his mallet;
- (f) Moves a ball, which is resting against a wire or peg, by striking that wire or peg.

The penalty for a foul stroke is that the turn ceases, and the balls remain where they are.

11.—A turn *ceases*

- (i.) On the player failing to make a point or roquet a ball;
- (ii.) On his failing to shake the ball off which he is taking croquet;
- (iii.) On his "killing" a ball;
- (iv.) On his making a foul stroke.

12.—If a player play out of turn or with the wrong ball, the remainder of the turn is lost, and any point or roquet made after the mistake. The adversary has the option of letting the balls remain where they lie, or replacing them as they were before the last stroke, also playing with whichever of his own balls he chooses.

If, however, the adversary play without discovering the mistake, the turn holds good, and all points made after the mistake are scored.

13.—If a player, after making a wrong hoop, makes a second stroke, the remainder of the turn is lost, and any point or roquet made by that stroke; the previous rule applying to the position of the balls. But if the adversary does not discover the mistake before a third stroke, the turn holds good, and the player who made the wrong point proceeds as if he had made no mistake.

[The severe penalties enacted in Rule 12 are necessary in public matches to prevent careless play, and the confusion resulting from it. In private games it often obviates sore feeling if a player warns his antagonist, should he see him about to play with the wrong ball.]

14.—If a striker in roquetting any of his own balls, after it is a rover, drive it against the finishing peg, that ball is "dead," and the turn of the striker's ball ceases.

[*e.g.*, B and A are both rovers, and it is A's turn. A wishes to roquet B gently, and then after croquetting it against the peg, "peg out" himself; but misjudging the required force, A roquets B against the peg; B is then dead, but A's turn ceases, so that the adversary has another shot at it before it can go out. The theory of this rule depends on Rule 8, as there is now no ball off which to take croquet, B being dead.]

15.—No ball has the power of making an adversary's rovers dead unless it is itself a rover.

[The point of this rule is that it is often advantageous to make a hostile ball dead, if its partner is some way behind, as a player has then two turns to his adversary's one; but this privilege is only allowed to a player who has a rover with which to do it.]

16.—A ball lying in a hole may be moved away from the direction in which it is to be played, and may be also brought out more than three feet from the boundary, if the stroke cannot be freely taken.

17.—The duties of an umpire are:—

- (i.) To decide disputed points, but *only* when appealed to;
- (ii.) To move the clips and mark the scoring card;
- (iii.) To set hoops or pegs upright in case of displacement;
- (iv.) To replace balls sent off the ground.

The decision of the umpire is final. The players have no appeal to the referee, who is

only to be consulted by the umpire in case of uncertainty on his own part. If the umpire stops or diverts a ball, when in play, he may replace it where he considers it would have gone.

To recapitulate some new terms which have been used in the summary, a ball is "in hand" after making a roquet, "killed" after crossing the boundary in taking croquet, "dead" after hitting the winning peg.

"Bisque" is a term that has as yet been unexplained. It is the means of equalising players in croquet handicaps. It confers the privilege of prolonging a turn at any moment by an extra stroke, provided that Rule 3 is not in any way violated.

So many bisques given to a player mean so many privileges of taking this stroke.

Matches at Croquet are now either single- or double-handed, *i.e.*, are played between only two players, each playing two balls in rotation; or between sides of two players, each playing one ball; but the former affords such a much better test of a player's skill, by giving him full command of the balls, that it is adopted for most of the important matches.

The single-handed game may thus be regarded as the true field for the display of tactics, although the double game claims a greater share of attention, from the popularity which its very name of "partner" matches suggests.

The players in single matches are drawn by lots in pairs, and then the winners are drawn in a second batch of pairs, and so on, till there are only two players left in to play the final rubber. In partner matches, the players are sometimes allowed to choose their partner before they enter, and sometimes put their names down singly, and are drawn in pairs.

In addition to single and partner matches, prizes called "break prizes," are offered at tournaments, and are won in the following way:—A gentleman or lady is allowed to place his or her ball in front of the first hoop, and arrange three other balls in any position on the ground; they must then start, and make as many hoops as possible with the first-named ball, and the player who goes through most before making a mistake, *i.e.*, who makes the longest break, receives a prize. The longest break on record is one hundred and thirty-seven points.

Handicaps are formed in Croquet by giving bisques to inferior players, that is to say, allowing them at any period in the game which they choose to take one or two or more extra strokes, as the case may be.

The players are arranged in classes, with a difference of a bisque between each, so that a player in the first class if drawn with one in the fourth would have to give him three bisques.

Addition and subtraction consist in having four shots at a row of hoops, planted in the ground, either separately or fastened together with iron, on either side of a stick. It can easily be set up at any moment on a lawn. The gentlemen then shoot at it from twenty yards, the ladies from fifteen yards, and count nine if their ball hits the stick, seven if it passes through the nearest hoop, five through the next, three through the next, and one through the last. If the ball strikes the wires between two hoops *without* passing through, the number of the outer hoop counts, *e.g.*, if a ball struck the wire between three and five, the stroke counts three.

The result of the four shots is then added up, so that thirty-six is the maximum. The subtraction consists in deducting five for every shot that missed the whole erection.

Any prudent Croquet player, before starting in a game, will take care to make two or three "splits" and "rushes," and take Croquet from one corner to another of the lawn on which he is going to play. This is all the more necessary, on grounds which are comparatively unknown to him, but even on familiar ground it is advisable, as a shower during the night or a hot sun in the morning makes a very perceptible difference in the rate of the speed at which the balls will travel over the ground, or, as it is briefly expressed, in the "time" of the grounds.

Judgment of strength is, as has been already said, the *sine quâ non* of a croquet player, any elaboration of tactics being impossible without it; but in order to have an opportunity for displaying judgment of strength there is needed a capability for making shots sometimes in order to obtain or regain command of the balls; so that preliminary practice had better be extended beyond learning the time of the ground to making a few shots, so as to "get the eye in."

Roquets may be divided into long and short, the former those effected from a distance of more than twelve yards, the latter those made at distances from one inch to twelve yards.

A doubt as to which is the easier will probably excite a smile of derision in our readers, and they will be surprised to hear that more matches are lost through missing the latter than the former.

The fact is, that no disgrace is felt at having missed a twenty yards' shot, and so there are no nervous qualms while the player is taking aim; but often when the ball is six or ten yards distant, at a critical moment, disquieting thoughts arise, "What a booby I shall look if I miss this!" "Oh, dear, I ought to be able to hit it! but"—the striker is doing his best to miss by giving way to such childish fears. Be sure of your medium-distance shots, and you will very soon become one of the most dangerous players. "How am I to be sure?" is the answer. Well, listen. First as to the eye, which had better come first, as there is a general consensus as to which is the right method.

At the moment of striking your eye ought to be *resting on your own ball*, and *not* on the ball aimed at.

Take a good look at the ball you wish to hit; then carry your eye back to the mallet, and point it according to the line which this glance has given; and, lastly, fix your eye on that part of your own ball which the mallet must hit in order to drive it straight; be sure, finally, to strike this part with the centre of the mallet's face.

You can easily ascertain whether you are accurate in this last point by observing the indentation or discoloration which is made on the face of the mallet by the ball.

On the mallet of a bad player the dark marks referred to may be seen all over the mallet's face, as much to the right as to the left of the centre; but a good player's mallet will present one round opaque mark in the centre, showing that the ball has been always struck true.

In order to have command of the ball, the player *must settle himself well on his feet*, put himself in an easy posture, so that the ball be opposite the *left foot*, and must not draw back his right foot too much.

One fatal error is to stand with both feet too close together; such an attitude promotes more than any other that downward chop of the mallet so much to be deprecated, instead of the easy lateral swing, which is only to be obtained by a body poised evenly between legs a little outstretched, and arms working well from the shoulders instead of from the elbows.

Tactics may be briefly described as the management of your own ball by itself, and in conjunction with others, in such a way that the required strokes are made easy for yourself, with the least possible risk of helping your adversary. Our last instructions, it is to be hoped, have led to some proficiency in the art of hitting a ball; but when the long-coveted shot has been made, what is to be done with the ball that has been hit? And by what means can we so arrange the balls as to run several hoops with the ball that has made the shot? Or how shall we leave them in positions favourable to the play of our next ball? It is in knowledge of this that real play consists; Croquet presenting a great similarity to billiards in this respect—for a mediocre billiard player will make brilliant hazards and startling shots on many occasions, but poor scoring will result from them, as he has no care

for the future position of the balls; while a really good player, whenever he gets a good hold of the balls, scores rapidly, owing to the way in which he works them into easy positions. So it is that a player who has little knowledge of Croquet will go banging about the lawn and make astounding shots; and yet, after all, his balls make little progress, and his opponent soon "gets in" again. How often one hears a disappointed bystander—who has come to see the play of a proficient at croquet or billiards—vent his spleen in words like these:—"Why, he never made a stroke that I could not have done myself!" Quite so; but you would never have given yourself the opportunity, as the art of the game consists in *contriving to leave yourself nothing but easy shots*, and as you do not yet possess that art, you would on most occasions have to execute difficult strokes, which may be easily missed.

In order to command success in this, which is the highest accomplishment of the croquet player, it is necessary to have a considerable practical knowledge of angles, tangents, and the laws of ricochet and rebound. In the ancient days of croquet, a stroke called a "tight croquet" was all the rage. The person who had roquetted a ball placed his own on the side of it, as in the present style, and then, putting his left foot on his own ball, gave it a smart hit on the side opposite to that in which the other ball was lying, leaning at the same time with great force on his left foot. The effect was that the ball struck by the mallet remained where it was, and the other flew off to a distance varying in proportion to the strength of the stroke. There were many and great objections to this practice, the chief of which were these: that it required little exercise of skill to send the adversary flying to the end of the ground, although much more was needed for putting a partner into position; that it gave an enormous advantage to a strong over a weak person, thereby destroying one of the chief merits claimed by the game—of equalising competition between the two sexes; that it made ugly and troublesome dents in the grass; and, finally, that hardly any stroke could be accomplished by it which might not be much better made by the system of Croquet that was substituted for it. It is true that if a player now requires to send the partner or adversary whom he has roquetted to a distance, remaining stationary himself, the old "tight croquet" would be convenient, and would serve the purpose rather better than the other. But a good player will croquet a ball a long way without moving far himself, by a skilful application of the system known in billiards as "breaking back." In order to accomplish this, it is necessary to hit the croquetting ball as low down as possible with a very smart hit or tap, immediately withdrawing the mallet, so that the reaction or rebound arising from the collision with the croquetted ball can operate upon the croquetting ball without being interrupted and annulled by the continuing action of the mallet. The force with which this reaction will work if left to itself can never be exactly tested with a croquet ball, as it is impossible to draw back the mallet quickly enough to allow it to exert its full force; but there can be no doubt that if by some mechanical or other contrivance the mallet could be removed out of the way at the exact moment of the stroke, the croquetting ball would remain stationary, while the other received the full force of the blow transmitted through it. This may be illustrated to some extent by experiments made either with an ordinary mallet and some bowls, or with ordinary full-sized croquet balls and a very diminutive mallet.

For effecting the following strokes, it is, of course, necessary to resort to exactly the opposite principle, and to allow the mallet to follow the croquetting ball as far as possible as it goes behind the other. For this stroke the heavier the mallet and the lighter the balls the easier is the task. It is, moreover, quite feasible to send the croquetting ball not only as far, but farther than the other, by making the mallet, as it follows on after the original blow, increase in

velocity and motive force. The diagram (Fig. 18) will show a position in which such a stroke may be of the greatest use, and not improbably enable the player to win what was before an almost hopeless game. He must be supposed to have roquetted a ball lying at a long distance from the hoop which he has to pass, and on the wrong side of it—that is to say, in front. Now he can, of course, take a common turn off it, and place himself in position for the hoop. But having done so, he will have a very long shot at the other ball to roquet it, and if he misses, will be nearly as badly off as he was before. If, however, he can send the other ball (n) up to a short distance of the hoop, and on this side of it, while he sends his own (m) just to the other side, he is then in for a good break, and it will be his own fault if, after passing the hoop, he does not keep the balls together, and ultimately win the game. The dotted lines show the course which each of the balls will take when dealt with in this fashion.

These two strokes may be considered as the opposite poles, between which there are an infinite variety of others destined to move the two balls with greater or less relative force, and in more or less diverse directions. The young player who desires to excel in this game must practise at it with much of the same assiduity expected of a cricket player or a billiard player, and will do well when by himself to devote some time to a study of those laws of "strength," inde-

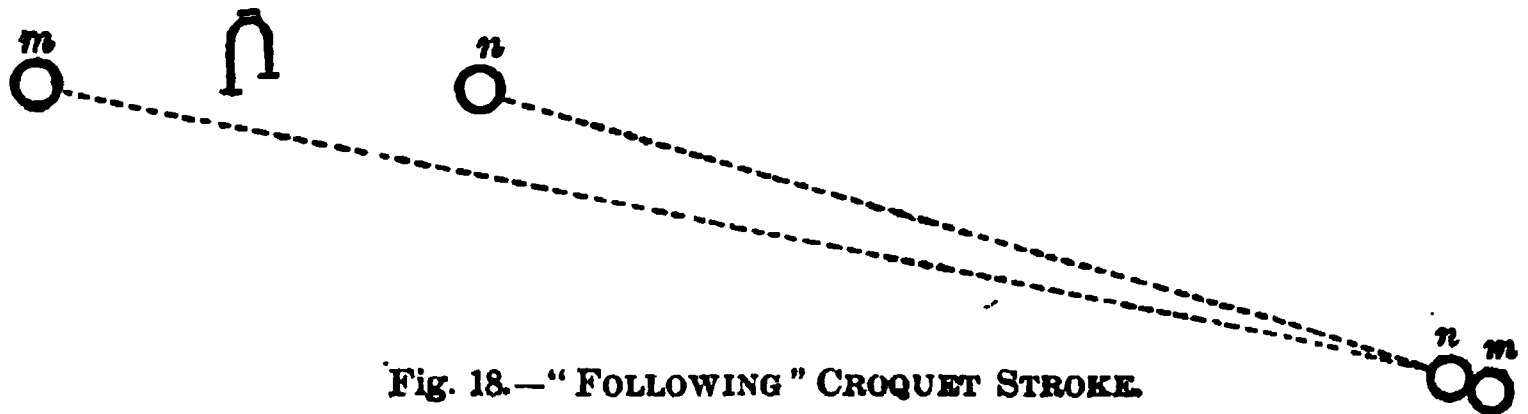


Fig. 18.—" FOLLOWING " CROQUET STROKE.

pendently of all use of the hoops and posts. Marking out spaces on the turf by means of tape or string, he may place the two balls together at gradually increasing distances, and in each case not be satisfied till he has placed each of them in the space marked out for its reception. When he can send the croquetted ball sixty yards into a circle two yards in diameter, and the other ball by the same stroke into another circle of equal size anywhere between him and it, he may consider that he has mastered the elements of the art as regards the question of "strength."

For the study of "split" strokes, another series of principles has to be applied. The first of these is exceedingly simple: it relates to the course taken by the croquetted ball. Whatever sort of stroke is given to the croquetting ball—whether it is hit hard or softly, "thick" or "thin"—the croquetted ball will always move in the same direction: that is to say, in a straight line with the centres of the two balls. Thus, if the croquetting ball is placed exactly to the south of the other, and then hit in any direction to the east, the west, the north, or any intermediate point of the compass, the croquetted ball will in all cases move away exactly to the north.

This being the invariable rule with regard to the croquetted ball, it remains to explain the more difficult rules which govern the course of the other. To understand these, let it be supposed that the two balls (m and n) are lying close together and touching one another, and that the croquetting ball (n) is struck by the mallet in the direction x to y (see Figs 19 and 20). The other ball will then fly off in the direction of a . In order to ascertain the direction taken by the croquetting ball, let a line be drawn from n to b , in such a way that the angle

$b n y$ is equal to the angle $a n y$. This line ($n b$) will be the natural course of the croquetting ball, if it is hit with tolerable force, so that each of the balls go to about equal distances from the place where they started. If, however, the stroke is a "following" stroke, and the mallet after hitting is driven forward, together with the balls, in the way already described, the course in which the croquetting ball (n) will then go is more directly forwards in the direction of y —that is to say, it will go towards a point (c) somewhere between b and y .

If, on the other hand, the stroke is a short, sharp hit, it will then glance off more obliquely to the side in the direction of d . The deflection of the line ($n d$) will be greater in proportion to the obliquity with which the ball (n) is struck, as in Fig. 19; but it will never be greater—or, at all events, it will never be much greater—than such as to form a right angle with $n a$. If it is desired to send the croquetting ball almost straight forward, and to

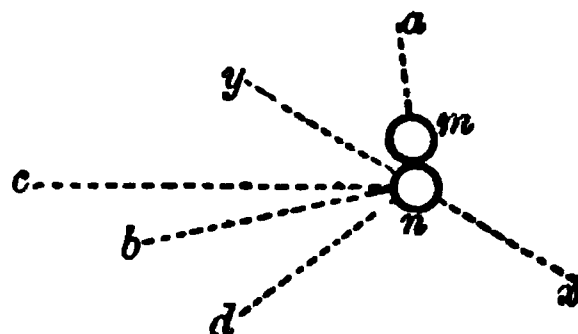


FIG. 19.—COURSE OF A CROQUETTING BALL.

leave the other ball almost where it was, the stroke will be given as in Fig. 21, and the ball (n) will then proceed to almost any distance in the direction of c , while the ball (m) is not moved more than a few inches. In order to move the croquetting ball to d in the same figure—that is to say, to a point which is at an obtuse angle from $n a$, it is necessary to hit it gently, but with a smart blow, drawing back the mallet immediately; but in this case the ball (m) will move

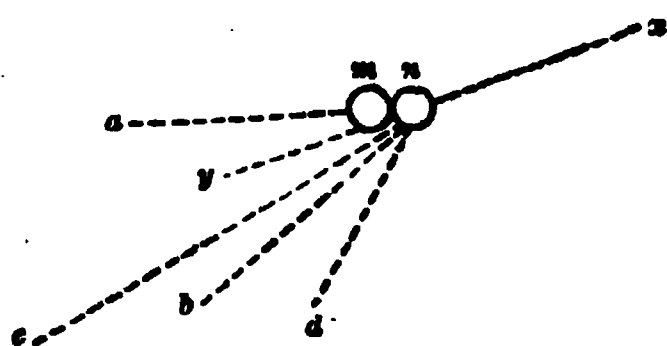


FIG. 20.—COURSE OF A CROQUETTING BALL.

farther, and the ball (n) cannot, even by a skilful player, be made to travel far in this direction.

It will be seen from these diagrams and the above remarks that a great deal depends upon the force with which the balls are hit and the nature of the blow delivered, since not only the distance travelled by each ball, but also the direction in which one of them moves, is governed by this consideration.

It is, however, still more important to place the balls correctly before hitting, so that a line drawn through the centres of the two balls will lie exactly in the direction which it is desired the croquetted ball shall take. But when all this art of science has been mastered, it still remains for the player to know what is the best stroke he can take under the varying circumstances of each game. Shall he, for instance, when at a long distance both from his friends and enemies, take a long shot at one of the latter, and risk the chance of so beginning a break? Or shall he pursue the slower, but perhaps surer, course of placing his ball near his partner, so that the latter may, when he gets his turn, be certain of a break? Much will depend upon a knowledge of the enemy's tactics, and of his skill in making long shots. If he is a very good hand at this, it will be unwise by going to the friend

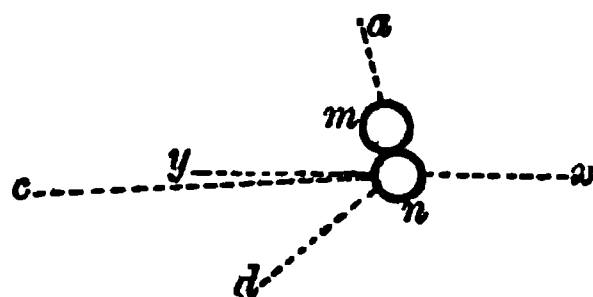


FIG. 21.—COURSE OF A CROQUETTING BALL.

to give him two balls to aim at close together; but if he is an indifferent shot, and timid in his play, he will be more likely to leave his foes alone, and so give them the chance for which they are preparing by getting them into close company. Another question is whether, when a break is in course of being played, it will be worth while to go out of the way and separate two enemies' balls which are close together, and pretty sure to do

mischievous if left to themselves. Much will depend also upon the state of the game. When the adversary is far advanced, and likely to win at the next turn or so, the most desperate attempts must be made to spoil his game and interfere with his plans; whereas a player who is well ahead will, perhaps, do better to hold on his course, and not go far out of the way to meddle with the foe. These and other questions connected with the "tactics" of the game can only be thoroughly learnt by long practice; but enough has been said to show that a vast amount of head-work as well as nerve and manual neatness is essential to all who wish to excel in what is really, in many respects, a most interesting and difficult game.

LAWN BILLIARDS.

THIS is a very simple game, invented before the more elaborate idea of croquet had been developed; and although it had for a certain time some enthusiastic admirers, it was soon thrown into the shade by its more ambitious and successful rival. The advantage which it has over both croquet and lawn tennis, is that it may be played on a very small space, the smallest patch of grass, if it is in good condition, being sufficient for a whole party of players, numbering from two to ten.

The apparatus required is, in the first place, a stout ring of metal, which



Fig. 22.—CUE FOR LAWN BILLIARDS.

serves the same purpose as the pockets in a billiard table. It is made of brass or iron, and is about five or six inches in diameter, having attached to it per-

pendicularly a long shank or pin, which is smooth and capable of turning easily, like a vane, in the socket in which it is placed. This socket should be also of smooth metal, fitting accurately to the pin. It is sunk in a post or large peg made of wood, which in its turn is driven into the ground up to its hilt. By this means the whole apparatus is buried except the ring, which projects above the turf and revolves round its axis at the slightest touch given to either of its sides. It is important that the socket and pin should be kept clean and constantly oiled, so that the latter should move freely and never become inclined to stick. The remaining implements are a number of balls made of heavy wood, about four inches in diameter, painted of a different colour, as the billiard balls for a game of pool. There should be as many of them as there are players in the party, or, if special balls are not forthcoming, large-sized croquet balls will do instead. There should also be a convenient number of "cues," which are shaped not at all in the same way as a billiard cue, but more like spoons (Fig. 22). The handle, which is about four feet long, is made of wood, and at its lower end is inserted a pin carrying on it a ring somewhat similar to the ring fixed in the middle of the ground, but much smaller. It is in fact about three inches and a quarter or three inches and a half in diameter, and is so constructed that the ball can rest in it easily without either slipping through or falling off at the side.

The game is played by inserting this ringed cue under the player's ball at the opposite side of it from the direction in which it is intended to send it. The ball is then half pushed and half lifted along by an action of the arms and hands, which resembles that of shovelling or pitching, and the object is to send it through the ring and thus score a point. Every time the ring is passed one ace is scored; but if the ball has previously cannoned off another ball, the player scores two. The winning score may be fixed at twenty-one, or any other number

agreed upon. The player is not entitled, however, after making one ace, to continue his stroke, as is the case both in billiards and croquet.

It will be found, after a little practice at this game, that there is considerable scope for skill and dexterity in it. In the first place, although it seems at first impossible to pass a ball through the ring (Fig. 23) unless it lies almost directly in front of it, on one side or other, yet persevering experiments will show that the task is by no means hopeless, even when the ball is situated obliquely and at a considerable angle. In such cases the ring must be hit on the inner part of one of its sides and so twisted round, while the ball by its own continuing impetus makes a way through, often not without a good deal of wobbling about against the two inner sides of the ring. Secondly, it will often be possible to get through by a judicious cannon against some other ball lying near the ring; and when this is done the advantage is doubly great, as the score is increased by two instead of only one, as it would be if the ring were simply run without any such device.

Fig. 23.—RINGING A BALL.

Another important element in the game is the science of disturbing the adversary by knocking his ball out of a favourable into an unfavourable position. When it stands facing the ring at a short distance from it, a fair hit will not only send it flying out of the way, but will generally leave the player's ball to occupy the good place so vacated. In order to produce this result it is, of course, necessary to hit the opponent's ball full and straight, for if it is only touched on one side it will be the cannoning ball which runs away into the distance, while the cannoned ball is not moved very far. The fourth and last important manoeuvre to be learnt and executed is that of "blocking" or stopping up the way to the ring, and for this a knowledge of pace and "strength" is quite as necessary as skill in directing the hit. Suppose an adversary's ball to be directly facing the ring and about a yard distant from it; while the player's ball lies two yards off, nearly at the side of the ring. It is impossible either to run the ring directly or to cannon through it, and the only good stroke is that of blocking the way by leaving your ball directly between the opposing player and the ring. Now only a first-rate player will so judge his hit as to perform this task, while a second-rate performer will not only fail to do it, but also probably leave his own ball in such a position that the adversary has a good chance of making a cannon off it, and so scoring more than he could have done if left alone. These are requirements which lend a great deal of interest to lawn billiards when the turf is good and the players really in earnest. The worst of the sport is, that it is a somewhat inactive one, and involves little real exercise. So that except on very warm summer days there is not much pleasure to be derived from it; and in fact in winter the hands and feet would be almost frozen during the process. Even in fine weather, if the grass is at all damp, there is some danger in playing a game which involves so much standing about; and it should be avoided altogether by all who have any tendency to weakness in the lungs. This disadvantage, together with the greater variety and excitement which was found to be provided by croquet, soon caused the former game to be eclipsed by the latter in popularity.

LAWN TENNIS.

LAWN TENNIS is an adaptation of the grand old game of tennis to out-door courts, which may be made wherever there is a sufficient expanse either of turf or of smooth ground. It is said to have been invented long ago; but it is only quite within late years that it has become a favourite game throughout the

country. It may be hoped, however, that it will long continue to enjoy its well-earned popularity, for it combines much of the interest and attractions of real tennis, with this immense advantage, that it can be played in the open air. For schoolboys it is rather to be called a holiday amusement than a school game. Where there are plenty of players available, cricket or football is a much more commendable, as well as, generally speaking, a more convenient game; but in holiday time comrades are not so easily to be found in abundance, and then the charms of a game that can be played by four, or even a smaller number, are soon appreciated. There is, moreover, this special recommendation of Lawn Tennis, that it can be played by girls as well as boys, and that ladies are not unfrequently known to be able to hold their own in a double game, or even in a single game, against really excellent players belonging to the stronger sex.

Fig. 24.—A LAWN TENNIS COURT.

The diagram (Fig. 24) represents a Lawn Tennis-court, with four players in the position they usually occupy at the moment when the game begins. The court, it will be noticed, is marked out rather differently from that in the rules on page 326, the service side lines being continued to the base lines at *k m* and *i l*: the advantage of so marking a court being that the single-handed game can be played on it by taking the service side lines as side lines for that game, and the court as it stands for the four or three-handed games.

The net is stretched across the court at a height of three feet in the middle, and of three feet six inches at each end. These ends are supported on poles, which are braced or stayed back by being attached with cords to two pegs in the ground; or, as is more general now, the net is suspended between two posts, which either fit into sockets in the ground, or are themselves fixtures in it; the net being tightened by drawing up the cord running through it at the top, by means either of a wheel or lever affixed to one of the posts. Of late years the many excellent inventions, in the way of fixed poles and fastenings, have almost entirely superseded the old posts and pegs, which had the serious disadvantage of continually requiring the readjusting of the net to the right height. The top of the net should be distinguished plainly by having a broad band of tape or braid run along it, as without some such mark it is sometimes difficult to see clearly where it is. Before commencing a game, the umpire or one of the players should see that the net is adjusted at the right height from the ground.

The net, when thus fixed, will measure forty-two feet from post to post. Inside the posts, and at a distance of three feet from them, straight lines will be drawn on the grass or the asphalt, or whatever ground serves as a floor, at right angles to the net, and reaching to a distance of thirty-nine feet on each side of it. The ends of these lines on each side are then joined by two other straight lines, which are of course parallel with the net, so that the whole court forms an exact parallelogram, seventy-eight feet long and thirty-six feet broad. It is divided into two equal parts by a line running lengthwise down it, so that on each side of the net there are two courts—a right-hand court (*c a l* and *f h k*) and a left-hand court (*d b m* and *e g i*). These courts are, again, once more intersected by a cross line, twenty-one feet from the net, which is called the “service line,” and which separates the ground on each side of the net into four rather unequally-sized courts. These are all the divisions which in the early stage of the game’s history were known or allowed; and it may be well to explain the manner of playing without complicating it by making any mention for the present of the service side lines *l i* and *k m*, which are referred to on page 324.

Supposing, then, that the player standing at *l* has won the toss or the “spin” for innings, and has elected to begin serving from this end of the court. He will stand at the edge of the court *a* with one foot outside the boundary line and one foot upon it, and then holding the ball in his left hand, will strike it over the net into the diagonally opposite court (*f*). If he fails to do so, and either strikes the net or places the ball in any other spot except at court *f* it is a “fault,” and if a second fault is served it scores a point for the opposite side. But what if the ball hits the top of the net, as it often does, and then falls over into the right court? Originally this was a good service; but a rule afterwards adopted has decided that it shall count as a “let”—that is to say, it shall make no difference whatever to the score, but the in-player shall serve again, just as if nothing had occurred. Suppose, however, that the service is a good one, and the ball falls straight and clean over the net into court *f*; one of the adverse players, who has been standing somewhere between *h* and *g*, will hereupon attempt to return it, by striking it at its first bound, and hitting it over the net. There is no limit to the height of the stroke. It may be as high or as low as the striker pleases, provided that the ball clears the net and falls somewhere within the outside boundary lines of the court opposite. It is not lawful to take a service at the volley—that is, before it has touched the ground once; nor may the other out-player take it instead of his partner, to whom the ball is served.

It is now the turn of the other side to return the ball, and this either of them may do by hitting it either at the volley or at the first bound. Generally the two partners on both sides take each one side of the court, and keep to it throughout the set, except when, owing to the rules about serving, they are

obliged to exchange. Other players divide the work, and set one partner to take all the balls falling in front of the service lines, while the other takes all which fall farther from the net; and this is perhaps the better plan when one of the players is good at volleying; for, as we shall see, the advantages which he can secure by his "up" play are very important. The server always starts from the right-hand court, as in Fig. 24, and serves into *f*; for his second serve he crosses over to the left of the centre line, and serves into *e*, his partner usually moving to a position in court *a*, somewhat similar to the one previously occupied in *b*. The out-players thus take the service alternately throughout the game. For the second game one of the out-players in the first game serves, the partner of the first server serving in the third game, the partner of the second server serving in the fourth game, and so on in the same order for all the subsequent games of the set.

The game being thus started, the ball is returned alternately from side to side until one player makes a failure, by either striking the ball into the net, or so as to fall somewhere outside the opposite court. It is sufficient for the ball to fall into the court, even if it should hit the top of the net on the way; for this, although it is counted a "let" in serving, is not so dealt with at any subsequent period in the game. When a failure is made, a "point"—that is to say, one stage in the game—is scored against the side which failed, and that whether the other side is or is not "in" at the time. This method of scoring is entirely different from that adopted at Racquets or Fives. There the person who serves must be put "out," and his place taken by the adversary before that adversary can score an ace; so that many services may be made, and result one after the other in a "hand out," without any addition being made to the score. In Lawn Tennis, on the other hand, every service must lead to some addition to the score (or some diminution of it) on one side or the other, and there is no such thing as putting a hand out. The person who began to serve continues serving till the game is finished; and thus a great deal of time is saved, and a good deal of trouble in shifting places is avoided.

The easiest way to explain a game of Lawn Tennis is to imagine one, and keep the score of it from beginning to end. Suppose, then, that *M* and *N* are playing against *x* and *y*. *M* serves from some point—any point will do—along the line which forms the outer boundary of court *a*. The ball, skimming over the top of the net, falls at the near end of court *f*; and *x*, who is posted there to return it, has to exercise some diligence in getting up in time to strike it at all. He does so, however; but the stroke is too vigorous, and the ball, flying past *N*, who wisely omits to volley it, falls just outside *m*, and gives a point to the adversary. The game is then called 15 to 0, or, as the correct phrase hath it, "15 love," love being equivalent, in the Tennis player's language, to nought. *M* then changes over to some spot along the left side of the boundary line, and serves into court *e* to *y*; *y* is more fortunate, or rather more skilful, than his partner, and returns the ball to *M*, *M* to *x*, and *x* to *N*, who hits it into the net. Now this failure, instead of putting *M* out, simply adds a point to the score of *x* and *y*, making the game "15 all." *M* now returns to the other side of the court, and in attempting to give one of his difficult low services, hits the ball too low, so that it fails to clear the net. This is a "fault," and being followed by another, gives a point to the adversary, making the game 15 to 30. At the next service into court *e* the ball is returned by *y*, and taken at the volley by *N*. The stroke is a good one, for it is a hard downward hit, and aimed straight at *y*. But *y*, instead of getting out of the way, holds up his racquet as a sort of shield, and the ball, striking against it, returns itself gently into court *a*, so far to the left of *N* that he cannot get across to it, and so near to the net that *M*, though he rushes up from the back part of the court, cannot arrive quite in time. This

gives another point to the out-players, and makes the game 15 to 40. Another failure, and M and his partner will lose the game. But M now thinks it time to wake up, and makes two good shooting services in succession, each of which the adversaries fail to return; and the score becomes 40 all, or rather "deuce."

It is now necessary for one side to score two points or "vantages" in succession. M gives another good successful service, and gains one of the "vantages." But his second service is less lucky; and Y, who has to play it, places his return stroke so deftly in the outer corner of court *a* that the partner of M, who is standing a bit too near the net, can neither volley it as it comes over nor get back to play it as it bounds. The vantage is lost; and the game returns to "deuce." M, who still continues to serve, now hopes to put an end to the long game by a couple of his brilliant services, but, in attempting to do so, again strikes the net, first at its extreme edge by the tape which runs along the top of it, and on the second trial still lower down. He is becoming impatient, and thus losing more than all the advantage which his superior skill and practice gave him to begin with. The game is now "vantage to X and Y;" and a single mistake on the part of the others will secure the victory to the out-players. In order to avoid a repetition of his last fiasco, which has justly annoyed his partner, M makes a rather easy service some feet above the net. The ball is returned sharply, and a severe struggle ensues, M and N straining every nerve to return it each time it comes across the net to them. They make a capital fight, and the ball flies backwards and forwards without a miss on either side, as if it would never stop. But from the first the in-players were the most put to it to make their returns, and Y, who intends to maintain his advantage, keeps placing the ball in all the most difficult corners of the court, where his opponents will have the greatest difficulty in getting to it. M, especially, is obliged to rush backwards and forwards from right to left, and from left to right, glad enough if he can return the ball at all, without much hope of "placing" it or "cutting" it so as to puzzle the out-players. He makes a good stroke at last, only an inch above the net. X, standing very close behind it, and keeping a very sharp look-out, is sorely tempted to volley it as it comes past him. But he feels that if he did so the chances are it would rebound too far, and fall outside the court. He exercises self-denial, therefore, and leaves the ball to his partner behind. Y can only just reach it, and he falls as he reaches out a long arm. But the ball is hit straight and true, and it flies sharp towards the net. If it clears it, it will puzzle both the others, and they get back to be ready for it. But it strikes the very top of the net. Hurrah for M and N! they may yet win the game. But, alas! although the ball has hit the net, it may yet roll over it. It does, and falls as gently as a rain-drop just on the right side. It is hopeless for N to try for it, however he may run forward. He is too late; and the second vantage, conferring the honours of victory, remains to X and Y.

Such is the sketch of a game at Lawn Tennis, the like of which may be seen any day on hundreds of lawns in England. The interest felt both by players and spectators is kept up to the very last, for the player who makes the worst start is never so far behind that he has not an excellent chance of catching up his opponent. There is no contest, perhaps, in which the quaint old saying that a game is "never lost till it is won" appears to have so much truth in it as in Lawn Tennis. Often are the three first points scored straight off by the in-player, and yet his adversary, thus left behind, works up to "deuce," and then, after a long tussle, secures a hard-earned victory.

Lawn Tennis matches are played in "sets" of eleven games, so that he who first secures six games is the winner of a set, except as in Law 22. After each set the players change ends, and this often makes a difference, for not only is the wind (when there is any) likely to make the play for one court more difficult

than for the other, but also in the afternoon or evening, the effect of the sun in one player's eyes is a great disadvantage to him. Good players will of course soon get accustomed to allow almost instinctively for the wind, but nevertheless, there will always remain some inequalities between the windward and the leeward side of the net.

There are several incidents to the game which deserve a passing notice. Volleying has already been explained; but it may be added that in a double game if one of the players is good at this branch of the art, and stands constantly close behind the net, he can influence to an extraordinary extent the fortunes of the game. It is wonderful what a large extent of space all along the top of the net within five feet of it and upwards will be covered by a really active player having a keen eye and a quick nerve. So difficult is it, indeed, to get a ball past him near the net that the adversaries, in order to avoid his ubiquitous racquet, often resort to spooning their balls up in the air, and so although they escape the Scylla of the up-player, fall into the Charybdis of affording to his partner an easy stroke which he will often return with fatal effect. Of late years, however, and especially since the lowering of the net and the prohibition of volleying over it, the best players have been more and more abandoning the practice of "up" play. Those who are opposed to it maintain that, although in a good many cases the up-player may succeed in intercepting the ball, and "killing" it by a sharp down-stroke, yet he must also in a large proportion of cases fail. And when he does so, and lets the ball go by, he leaves his partner single-handed to guard the whole length and breadth of the full court behind. It is, therefore, very likely, if the up-player does fail to return the ball, the back-player will also be unable to do so, and thus more is lost by the attempt than is at all likely to be gained. The great object with a Tennis player being to protect his court and return every ball, it is, as they argue, unwise, on the chance of making some telling strokes, to run the risk of leaving that court unguarded. It is pretty easy, say they, to run in to the net to take a drop-stroke which just comes over it, but wholly impossible for a man standing at the net to get back to the farther court, or even to attempt any return except a volley. For these reasons they are more disposed than they were to believe in the principle of assigning one side of the court to each partner, and leaving him to take the balls which come to that side either at the volley or on the bound, as seems to him easiest and best. There is in this plan certainly one very great advantage which cannot well be overrated. It is this, that when each partner has his own territory to guard, and knows exactly what balls he is expected to take and which he ought to leave alone, there is little opportunity for jealousy or annoyance arising between the two. Fortunately, English men and boys are gifted with amazingly good tempers, and are generally above such mean proceedings as bickering and recrimination. Still it is undeniably annoying to see your partner, who is playing "up," hit wildly at a ball which is coming over the net straight to you, and utterly spoil the stroke which you were prepared to make and which you fondly imagined would be a good one. It is a severe trial of patience to bear this meekly; and the feeling that you are probably annoyed has also its disagreeableness for the well-meaning but offending partner. By taking separate sides you avoid the risk of such unpleasantness; and this is an additional argument, though not of course the principal reason, for adopting that arrangement.

With regard to learning the art of Lawn Tennis, there are not very many hints to be given to the beginner beyond those which have already been mentioned in our remarks upon Tennis and Racquets. Those who have had any experience of these games, and especially the former, will very soon become adepts at Lawn Tennis, and will probably, after one or two games, beat with ease many Lawn Tennis players who have been learning for weeks and months. For the benefit

of those who know nothing of such games, we may give a few hints which will save them from the faults most commonly committed.

The first requisite in a young player—and, for that matter, in an old one also—is to return the ball somehow or other. Let the return be made in the shape of a good stroke, if possible; there is no fault to be found with that. But whether good or bad, let it be at least well and safely over the net, for if it falls short nothing can prevent the adversary from scoring a point against you. As long as it gets over there is at least a chance that you may win the ace, however easy the ball may be to take. The adversary may be too eager, or try to be too clever, and make a miss altogether. Or he may send the ball back to your partner, who may then make a brilliant and successful stroke. At any rate, if he misses, the discredit is his, not yours. Remember, that the discredit of missing a stroke is, or ought to be, always considered far greater than the credit of making a fine stroke.

As a general rule, players should endeavour, both in serving and returning a ball, to hit it hard and low over the net; there will, of course, be exceptions to this rule, as, for instance, with a good player at the net it is often necessary to lob a ball over his head. "Placing," or putting a ball into that corner of the court most difficult for your adversary to reach, is an art only to be acquired by practice. In serving, whether a player adopts the under- or the over-hand style (which latter is now much in vogue), he should always make certain of getting his second serve into the court, because nothing is so annoying to a partner as a series of faults. The other maxims which should be borne in mind are—to hold the racquet with its face forward, and parallel with the net, and in striking to present it as nearly as may be in the same position, only with its face sloping slightly upwards, unless the ball is high up, or coming with force in an upward direction, in which cases it should be held so that the lattice work is exactly perpendicular. Volleying is a dangerous practice, for it is difficult, even supposing that the ball is taken full and fairly, to "place" it skilfully in the opposite court. It is unadvisable on the part of the "up" player because he thereby generally spoils his partner's stroke; and on the part of the back player, because if he left the ball alone it would probably go out of court. There are, nevertheless, many obvious cases where both the one and the other may volley with advantage; while in a single-handed game it is essentially necessary for a player to be almost as good with these as with the more ordinary strokes.

Other rules are, "not to take your partner's strokes"—that is, the balls which fall, or are about to fall, into his court; not to lose your temper, nor to find fault with your partner; not to rail at luck when you have missed a stroke or lost a game. Above all, however, do not abandon the hope of returning a ball till you have done your very utmost. Many strokes which look impossible are made by a desperate effort, beyond the hopes of the striker; and as the practice of trying for them becomes more inveterate, it is found that there are fewer and fewer balls which cannot be taken. Energy and perseverance, and a determination to do all that can be done to win, achieve wonderful results at this game, which is, indeed, one of those at which a player may go on indefinitely improving. It is, at the same time, one in which the temptations to laziness are great, and prove fatal to a vast number of players who might have done well if they had stuck to it with courage from the first. There can be little real enjoyment in a game played in such a fashion; and the boy who strikes idly and carelessly, and is listless as to winning or losing, will soon find himself excluded from sets in which the real lovers of the game are engaged.

It remains now to mention some changes which have been made in the game

since it was first taken up with vigour in England. These have mostly been designed to make strokes more easy, or in other words to prevent those strokes which it is almost or quite impossible to return. With this view an inner line on each side of the ground has been run across it parallel with the side lines, four feet and a-half from them, and at right angles to the net. These lines will be seen marked in the diagram (Fig. 24) at *k m, l i*. They are intended to serve two purposes. In the first place, in a four game, they cut off from the four inner courts, into which the ball is served from time to time, a considerable part of the extreme portion, where it used in former times to be most easy to place difficult services. Unless the ball falls into the other, the central part, it is now a "fault," just as much as if it fell too far into the back courts. This, it will be observed, is a decided advantage to the out-player, and a proportionate obstacle to the server. In the second place the lines serve, in a single game, to reduce the size of the court, by cutting off the outer portion between them and what is in a four-game the boundary. Formerly it was almost more than an ordinary player could hope to do to get about all over a full-sized court. He can now, if possessed of tolerable activity, accomplish this with success, and has his own want of skill to blame if he cannot return the ball whenever it falls within the court thus circumscribed.

Another very important alteration relates to "volleying over the net," that is to say, reaching the racquet over the net and taking a ball while it is still on the opposite side. There must always have been a great doubt as to the legality of this manœuvre, which may be compared to taking a ball at the wicket before it has passed the crease for the purpose of stumping a batsman, and it conduced much to the interest of Lawn Tennis when, in 1880, the authorities adopted the rule that by volleying the ball before it passes the net the player loses a stroke.

LAWS OF LAWN TENNIS

as adopted by the Marylebone Cricket Club and the All England Lawn Tennis Club.

The Single-handed Game.

1. For the single-handed game, the Court is 27ft. in width and 78ft. in length. It is divided across the middle by a net, the ends of which are attached to the tops of two posts, *A* and *A*, which stand 3ft. outside the Court on each side. The height of the net is 3ft. 6in. at the posts, and 3ft. at the centre. At each end of the Court, parallel with the net, and at a distance of 39ft. from it, are drawn the *Base Lines*, *CD* and *EF*, the extremities of which are connected by the *Side Lines*, *CE* and *DF*. Half-way between the *Side Lines*, and parallel with them, is drawn the *Half Court Line*, *GH*, dividing the space on each side of the net into two equal parts, called the *Right* and *Left Courts*. On each side of the net, at a distance of 21ft. from it, and parallel with it, are drawn the *Service Lines*, *XX* and *YY* (Fig. 25).

2. The balls shall not be less than 2½in. nor more than 2 9-16in. in diameter, and not less than 1 7-8oz. nor more than 2oz. in weight.

3. In matches where Umpires are appointed, their decision shall be final; but, where a Referee is appointed, an appeal shall lie to him from the decision of an Umpire on a question of law.

4. The choice of sides and the right of serving during the first game shall be decided by toss; provided that, if the winner of the toss choose the right to serve, the other party shall have the choice of sides, and *vice versa*.

5. The players shall stand on opposite sides of the net: the player who first delivers the ball shall be called the *Server*, the other the *Striker-out*.

6. At the end of the first game, the *Striker-out* shall become *Server*, and the *Server* shall become *Striker-out*; and so on alternately in the subsequent games of the set.

7. The *Server* shall stand with one foot beyond (*i.e.*, farther from the net than) the *Base Line*, and with the other foot upon the *Base Line*, and shall deliver the service from the *Right* and *Left Courts* alternately, beginning from the *Right*.

8. The ball served must drop within the *Service Line*, *Half Court Line*, and *Side Line* of the Court, which is diagonally opposite to that from which it was served, or upon any such line.

9. It is a *fault* if the service be delivered from the wrong Court, or if the *Server* do not stand as directed in Law 7, or if the ball served drop in the net or beyond the *Service Line*,

or if it drop out of Court or in the wrong Court: it is not a *fault* if the Server's foot, which is beyond the Base Line, do not touch the ground at the moment at which the service is delivered.

10. A fault may not be taken.

11. After a fault, the Server shall serve again from the same Court from which he served that fault, unless it was a fault because served from the wrong Court.

12. A fault may not be claimed after the next service has been delivered.

13. The service may not be *volleyed*—i.e., taken before it touches the ground.

14. The Server shall not serve until the Striker-out is ready. If the latter attempt to return the service, he shall be deemed to be ready.

15. A ball is *in-play* from the moment at which it is delivered in service (unless a fault) until it has been volleyed by the Striker-out in his first stroke, or has dropped in the net or out of Court, or has touched either of the players, or anything that he wears or carries, except his racquet in the act of striking, or has been struck by either of the players with his racquet more than once consecutively, or has been volleyed before it has passed over the net, or has failed to pass over the net before its first bound (except as provided in Law 17), or has touched the ground twice consecutively on either side of the net, though the second time may have been out of Court.

16. It is a *let* if the ball served touch the net, provided the service be otherwise good: or if a service or fault be delivered when the Striker-out is not ready; or if either player be prevented by an accident beyond his control from serving or returning the ball in-play. In case of a *let*, the service or stroke counts for nothing, and the Server shall serve again.

17. It is a good return although the ball touch the net, or, having passed outside either post, drop on or within any of the lines which bound the Court into which it is returned.

18. The Server wins a stroke if the Striker-out volley the service, or fail to return the service or the ball in-play (except in the case of a *let*), or return the service or ball in-play so that it drop outside any of the lines which bound his opponent's Court, or otherwise lose a stroke, as provided by Law 20.

19. The Striker-out wins a stroke if the Server serve two consecutive faults, or fail to return the ball in-play (except in the case of a *let*), or return the ball in-play so that it drop outside any of the lines which bound his opponent's Court, or otherwise lose a stroke, as provided by Law 20.

20. Either player loses a stroke if the ball in-play touch him or anything that he wears or carries, except his racquet in the act of striking; or if he touch or strike the ball in-play with his racquet more than once consecutively; or if he touch the net, or any of its supports, while the ball is in-play; or if he volley the ball before it has passed the net.

21. On either player winning his first stroke, the score is called 15 for that player; on either player winning his second stroke, the score is called 30 for that player; on either player winning his third stroke, the score is called 40 for that player; and the fourth stroke won by either player is scored game for that player, except as follows:—

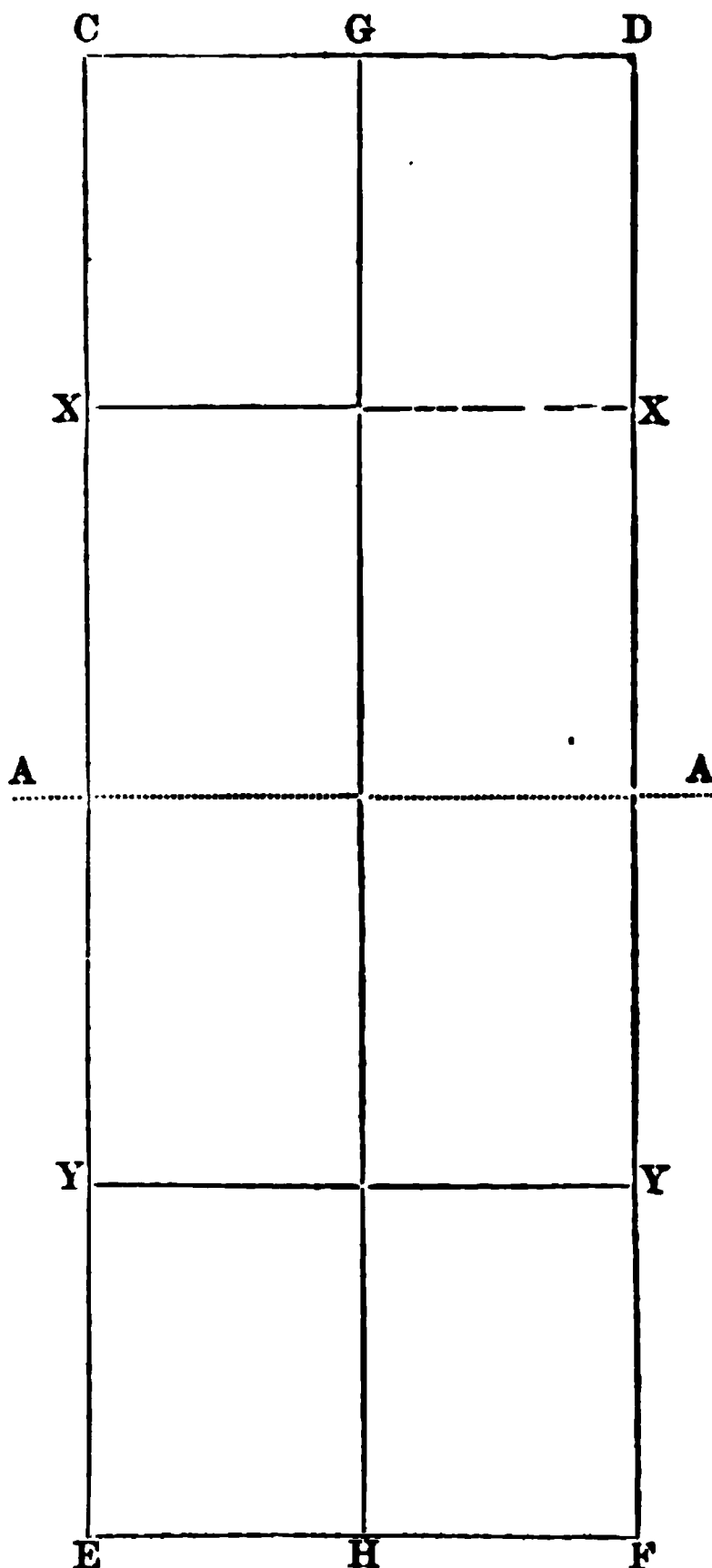


FIG. 25.—PLAN OF COURT FOR THE SINGLE-HANDED GAME.

Scale 1/4 in. to a yard.

If both players have won three strokes, the score is called *deuce*; and the next stroke won by either player is scored *advantage* for that player. If the same player win the next stroke, he wins the game; if he lose the next stroke, the score is again called *deuce*; and so on until either player win the two strokes immediately following the score of *deuce*, when the game is scored for that player.

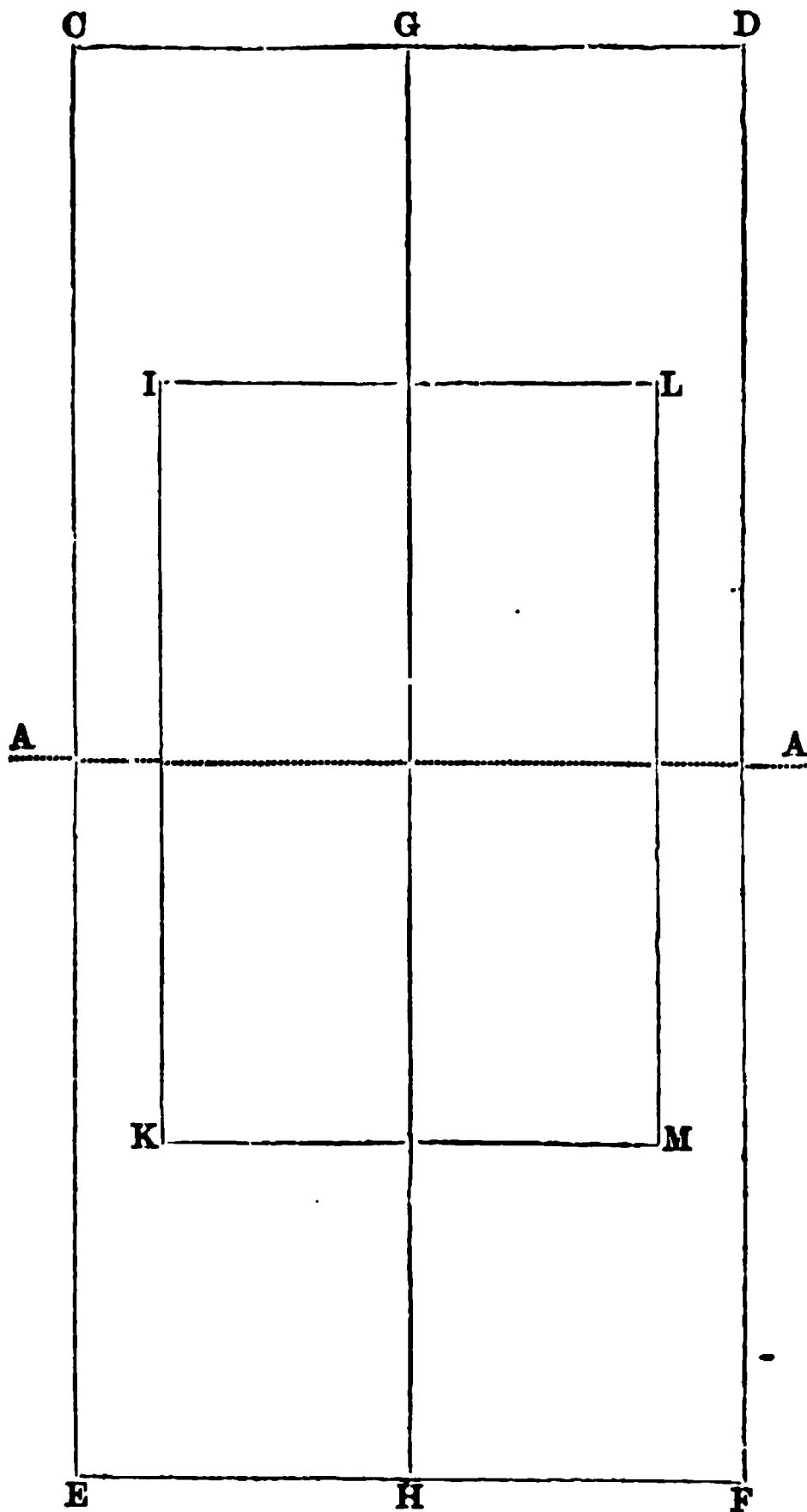


Fig. 20.—PLAN OF COURT FOR THE THREE-HANDED AND FOUR-HANDED GAMES.
Scale 1-6in. to a yard.

22. The player who first wins six games wins a set, except as below:—

If both players win five games, the score is called *games-all*; and the next game won by either player is scored *advantage-game* for that player. If the same player win the next game, he wins the set; if he lose the next game, the score is again called *games-all*; and so on until either player win the two games immediately following the score of *games-all*, when he wins the set.

NOTE.—Players may agree not to play *advantage-sets*, but to decide the set by one game after arriving at the score of *games-all*.

23. The players shall change sides at the end of every set, but the Umpire, on appeal from either party before the toss for choice, shall direct the players to change sides at the end of the first, third, and every subsequent alternate game of each set, provided that in such event the players shall not change sides at the end of a set if the number of games of such a set be even; but if the appeal be made after a match has begun, the Umpire shall only direct the players to change sides at the end of the first, third, and every subsequent alternate game of the odd and concluding set.

24. When a series of sets is played, the player who was Server in the last game of one set shall be Striker-out in the first game of the next.

Odds.

25. In the case of received odds:—

- a. One quarter of fifteen is one stroke given at the beginning of the second and every subsequent fourth game of a set.
- b. Two-quarters of fifteen is one stroke given at the beginning of the second and every subsequent alternate game of a set.

c. Three-quarters of fifteen is one stroke given at the beginning of the second, third, fourth, and the three last of every subsequent four games of a set.

d. One, two, or three-quarters of fifteen may be given in augmentation of other odds.

e. Fifteen is one stroke given at the beginning of every game of a set.

f. Thirty is two strokes given at the beginning of every game of a set.

g. Forty is three strokes given at the beginning of every game of a set.

26. In the case of owed odds:—

- a. One-quarter of fifteen is one stroke owed at the beginning of the first and every subsequent fourth game of a set.

- b. Two-quarters of fifteen is one stroke owed at the beginning of the first and every subsequent alternate game of a set.
- c. Three-quarters of fifteen is one stroke owed at the beginning of the first, third, and fourth of the first four and every subsequent four games of a set.
- d. Fifteen is one stroke owed at the beginning of every game of a set.
- e. Thirty is two strokes owed at the beginning of every game of a set.
- f. Forty is three strokes owed at the beginning of every game of a set.

The Three-handed and Four-handed Games.

27. The above laws shall apply to the three-handed and four-handed games, except as below.

28. For the three-handed and four-handed games, the Court is 36ft. in width. Within the Side Lines, at a distance of 4½ft. from them, and parallel with them, are drawn the Service Side Lines, IK and LM. The Service Lines are not drawn beyond the points I, L, K, and M, towards the Side Lines (Fig. 26). In other respects the Court is similar to that which is described in Law 1.

29. In the three-handed game the single player shall serve in every alternate game.

30. In the four-handed game, the pair who have the right to serve in the first game may decide which partner shall do so, and the opposing pair may decide similarly for the second game. The partner of the player who served in the first game shall serve in the third; and the partner of the player who served in the second game shall serve in the fourth; and so on in the same order in all the subsequent games of a set.

31. The players shall take the service alternately throughout each game; no player shall receive or return a service delivered to his partner; and the order of service and of striking-out, once arranged, shall not be altered, nor shall the Strikers-out change Courts to receive the service, before the end of the set.

32. The ball served must drop within the Service Line, Half Court Line, and Service Side Line of the Court which is diagonally opposite to that from which it was served, or upon any such line.

33. It is a *fault* if the ball do not drop as provided in Law 32, or if it touch the Server's partner or anything that he wears or carries.

34. If a player serve out of his turn, the Umpire, as soon as the mistake is discovered by himself or by one of the players, shall direct the player to serve who ought to have served; but all strokes scored, and any fault served before such discovery, shall be reckoned. If a game shall have been completed before such discovery, then the service in the next alternate game shall be delivered by the partner of the player who served out of his turn; and so on in regular rotation.

QUOITS.

THE game of Quoits, which, be it observed, differs greatly from the celebrated Grecian exercise known by the same name, is one of those which require a considerable amount of muscular force besides skill and steadiness of nerve. The *discobolia* of the Greek contests consisted of a trial who could send the quoit, or rather disc, to the greatest distance; and it was a test of strength in the back, shoulders, and forearm. In our English game, although strength is an advantage, it need not be possessed in a very marked degree; and there are some, although perhaps not many, good Quoit players who have no great development of muscular power in the arm and shoulder. The quoit itself is so well known as to need little description. It is a ring of iron shaped like the base of a wine-glass, if it be imagined that a circular piece were taken out of the middle of it, leaving a flat ring, which has its

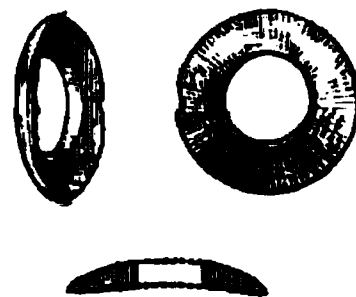


Fig. 27.—THE QUOITS.

inner edge thicker than the outer, and which has its lower surface flat or concave, while the other is raised or convex (Fig. 27). The only other requisites for the game are a flat piece of turf thirty yards long and a few feet wide, and two



Fig. 28.—HOLDING THE QUOIT.

“hobs,” which serve as the mark to be aimed at. The hobs are made of iron or wood, and are in the shape of tent-pegs, driven into the ground, until about an inch of them is left projecting above the surface. In the absence of “hobs” properly made, the game is not unfrequently played with feathers, or even small sticks instead of them. The quoits are of such size and weight as the player chooses, or as may be agreed upon, but they are in no case allowed to measure more than eight inches from outer edge to outer edge. They are held (Fig. 28) in a peculiar way between the thumb, which is on the convex side, and three of the fingers, which are on the concave side. On the outer edge is to be found a small dent, in which the end of the forefinger is placed, the rest of that finger being laid along the rim of the quoit. The

use of this is to impart a twirling or rotatory movement to the quoit, enabling it to fly without wobbling in the air, and to fall clean and direct upon the ground in the same position as it had when discharged.

When the sides have been chosen the first player stands level with one of the hobs, and taking a step forward with his left foot (or his right foot if he is left-handed) delivers the quoit by a swinging movement of the arm from behind him to the front. The quoit must fall and remain with its convex side uppermost, either embedded in the earth or clay or else lying flat with the concave side on the ground. If it rolls along the ground and then stops, it does not count unless the cause of its rolling was a collision with some other quoit already delivered, or unless, after having been properly thrown, it is knocked out by another afterwards played. The proper rule is, that each player should play his two quoits in succession, and then be followed by the adversary; but in a party of four it is usual for each player to have only one quoit. When all the quoits are thrown the score is taken by measuring the distance from the hob to the nearest part of the nearest quoit, and the side which has thrown best scores one or two, according as his one or two quoits are better than any one thrown by the other side. But every “ringer,” or quoit which falls over the hob and remains with the hob enclosed within its ring (Fig. 29, A), counts two; and in some places the feat of cutting the hob (Fig. 29, B) also scores one or two points. The distance between the two hobs may be any one which the players select, but it is usually nineteen yards, and the game is also generally reckoned at twenty-one points.

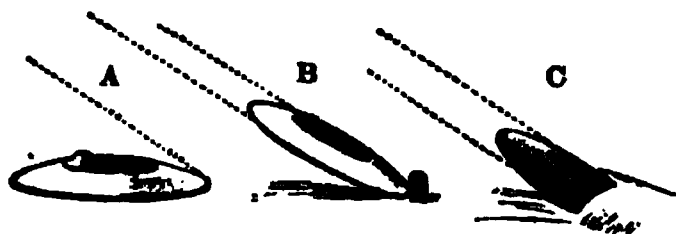


Fig. 29.—A GOOD END.—A, A RINGED QUOIT; B, A CUTTER; C, A QUOIT PITCHED TRUE (CORRECTLY EMBEDDED IN THE CLAY).

Some skill is required to insure that the quoit, when it falls, shall cut directly into the soil, and so retain its place; and the more straight and steady its flight is, the less likely will it be to be disturbed or knocked out by a subsequent player. It is of course necessary to have a good eye, to judge not only of the distance to be thrown, but also of the space which remains open after the adversary's quoit has been placed in a good position. The young player will do well in practice not to stick constantly to the same limit of distance, but to change it by extending it to twenty, twenty-five, or even thirty yards, until he becomes strong enough to throw those distances without great fatigue or effort.

GAMES OF SKILL.

BAGATELLE.

As a scientific game, bagatelle can no more be compared to billiards than draughts to chess, or nine-pins to cricket; yet in many respects it has great advantages over billiards, the first and chief being that in the majority of private houses bagatelle can be played and billiards cannot, on account of the large amount of space the latter table requires. Another point in favour of bagatelle is that a beginner does not necessarily make that exhibition of himself the first time he plays, as he would at billiards. The element of chance enters so largely into the game, that often the veriest beginner in the party will make the largest score.

Bagatelle-tables vary considerably in size, the smallest being about 5 feet long by 1½ wide, and the largest 12 feet long by three feet wide. The surface or bed of the table is of slate, covered with green cloth, and is shut in on every side by indiarubber cushions.

Fig. 1 represents the table, which it will be seen is round at one end and square at the other; *a* and *b* are two small spots, the use of which will be explained by-and-by. The round holes marked from 1 up to 9 are as many cups let into the table, and of sufficient size to exactly fit half of each of the ivory balls, of which there are nine, viz., four white, four red, and one black. It is very important, in order to play the game well, that these balls should not only be the same size, but the same weight, as, should one be heavier than another, it will be impossible to calculate the exact direction in which they will go after striking one another. The balls are struck with either a cue (Fig. 2) or a mace (Fig. 3); of these two the latter will be found the easier, especially when, as is often the case in private houses, the cue is not provided with a leather top. Now, as a top to the cue is certainly an immense assistance in hitting the ball correctly, a few words of instruction as to how to fit a cue with this necessary piece of leather may be of value. If the cue is a very small

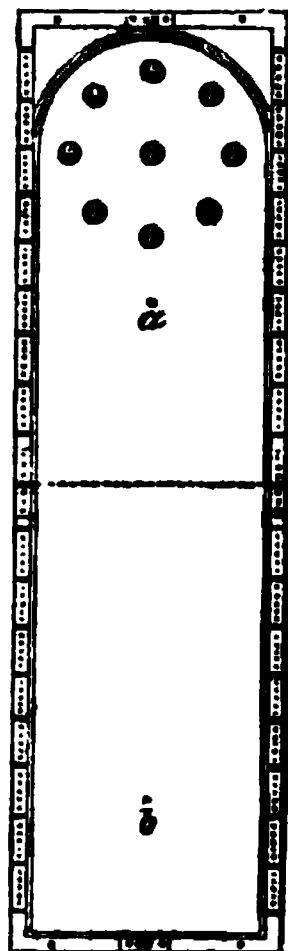


Fig. 1.
THE TABLE.



Fig. 2.—THE CUE.



Fig. 3.—THE MACE.

one, a thin piece of leather must be chosen, but if the cue be of a fairly good size, a thick piece will be found best. First, with a sharp knife cut a small square piece of leather, bigger than the top of the cue. Next with a file scrape the top of the cue till it is quite smooth and flat—and by flat we mean, be sure that the

surface is exactly perpendicular to the length of the cue, or otherwise the top will be found to be slanting. Next obtain some good *hot* glue, and having first warmed the top of the cue and the piece of leather—this latter by placing it on the hob of the fireplace for a few minutes—apply some glue to the flat surface of the cue and press it on the leather, and continue to press it for some time. The

cue and square piece of leather fastened to it should now be put away for at least twenty-four hours, when the glue will be found to be quite hard. Now take the cue and press the top down on a piece of board, keeping the cue upright, and with a very sharp knife cut the leather round, taking care in doing so not to take little slices off the cue itself. Having done this the top can be smoothed and made to look neat and finished by means of a sheet of rather fine sand-paper. A small piece of chalk will be found useful to rub the top with, as it prevents it from slipping. The size of the cue ought properly to be somewhat in proportion to the size of the balls. When these latter are very small, a full-sized cue, such as is used in billiards, will be found to be far too large.

As has been said before, beginners, and especially ladies, will find the mace the easier to play with; should, however, the cue be preferred, the annexed diagram (Fig. 4) shows the position in which it ought to be held. It will be found, however, that it takes some time to get accustomed to this position, and that at first the cue has a tendency to wriggle from side to side. In using the mace the chief point is to make it push the ball, and not hit it; great care, therefore, should be taken to insure it *touching* the ball before playing the stroke. Perhaps the best test of a good stroke is the sound. If on playing there is a sharp *crack* heard, it is in consequence of the end of the mace not being kept close enough to the ball. A slow, steady push ought to be accomplished without any sound at all. Before commencing the game it is of the utmost importance to

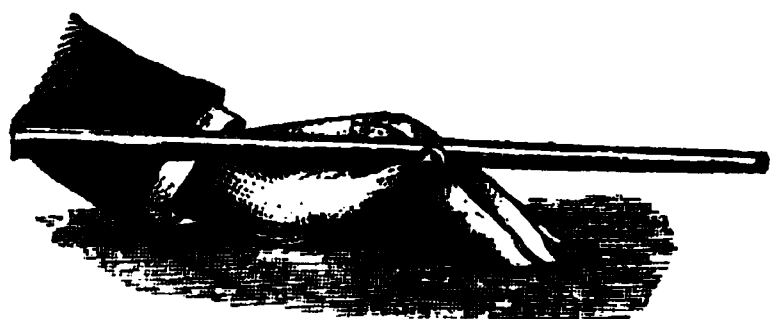


Fig. 4.—POSITION FOR STRIKING.

get the table as level as possible. Most bagatelle-boards are made to shut up, and are placed, when open, on a large table. Now it will be found that an ordinary round drawing-room table, which rests on one central leg, is not steady enough for the purpose; it is therefore desirable to choose a dining-room table that rests on four legs. In order to see whether or not the board

is level, take five or six of the balls and roll them all together down the table; should they all roll on one side, pieces of paper must be placed underneath, till it is found that the balls have no tendency to roll one way more than another.

Several kinds of games are played on the bagatelle-board, the most generally known being the English (often called "La Bagatelle"), Sans Egal, Mississippi, and the Cannon Game.

THE ENGLISH GAME.

This may be played by two or more players; where there are more than two they should be even in number, so that they may divide and make two equal sides.

At the commencement of the game the black ball should be placed on the spot marked *a* (Fig. 1). The eight red and white balls being taken off the table, or kept close against the side of the table nearest the player, one of them is placed on the spot marked *b*. The player then has to strike the black ball with the ball he plays with. Should he miss the black, the ball (his ball) is taken off the table altogether, whether it runs into a hole or not. In every board that folds up in the middle, it will of course be found that there is a crease in the cloth where the fold is. Any ball that runs back over this line is considered dead, and is taken up; the player, therefore, at starting, should be careful not to hit the black ball too hard, for it is of much more consequence that it should not be dead than any other, and for this reason "the black ball counts double." All balls that are struck off the table must be removed from play.

The object of the player at starting should be to strike the black ball so as to send it into or near some hole that is marked high. Of course, the centre hole, being marked nine, would be the best; but then it is very difficult, at the first shot especially, to put the black into the nine, and in attempting it there is considerable danger of knocking it into the *one*, the lowest marked hole of all. Moderate players, therefore, are recommended at starting to aim to hit the black ball rather on the right-hand side, so as to send it in the direction of the next highest-marked hole, viz., the eight. The effect of this stroke is very often to send the black ball into the eight, and at the same time the ball played with—which of course rebounds in the opposite direction—into the seven, thus making twenty-three in one stroke. It is obviously inferior play to hit the black ball on the left-hand side, as, should the black be sent into the seven and the white ball into the eight, only twenty-two instead of twenty-three would be scored; and it is evident from the symmetry of the table that one stroke is just as easy to be made as the other. The black ball being once hit, it is not necessary that any ball should be hit previous to scoring; when therefore the black ball has been holed at starting, it is the best play to simply try for the remaining holes in their order of merit. But, as we have said before, the nine is a difficult one to obtain; beginners therefore should try for the seven and eight, if they are vacant, before playing for the nine.

The dotted lines on the diagram (Fig. 5) show how each of the principal holes can be obtained, and it will be observed in each case that the cushion is struck first. To commence with the easiest, viz., seven and eight. The dotted lines show the direction of the ball; but what will be found to be the greatest difficulty is the strength. If the stroke be played too hard the ball will not go into the hole; and if the stroke be played too slowly the ball has a tendency to fall under the cushion. This latter is as a matter of course the fault of the table or board, but as it is almost universal, even in large boards well levelled, we think it desirable to mention it. The stroke requires a happy medium between running right over the hole, and not reaching the hole at all, that nothing but practice will give.

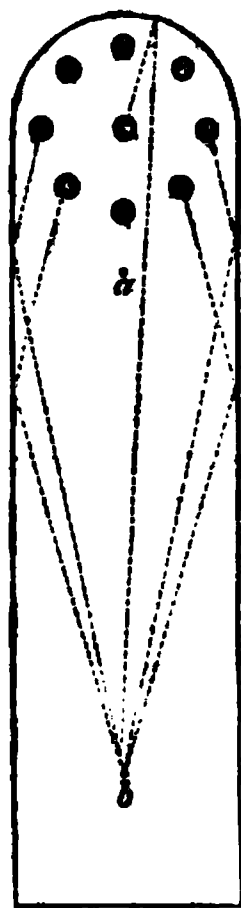


Fig. 5.

Bagatelle-boards of course differ greatly, and the coarser the cloth the harder it is necessary to play. The six and the four can be obtained not only by hitting the cushion in the points we have shown in the diagram, but by playing for them directly. The *nine* is always an attractive shot, and must be played for by hitting the top cushion on either side of the five hole; the ball will be found to rebound in the direction of the dotted line on the diagram; but the exact spot on the cushion differs slightly according to the table, and varies with the elasticity of the cushions, the material of which the cloth is composed, and even the temperature of the room. The diagram will be found, however, a sufficiently good guide to enable any one to find out, with a few trials, the exact place on any table at which to aim to obtain any hole required.

The best method of getting the black ball into the centre hole (the nine) at starting is to hit it dead full and sufficiently hard to cause it to jump over the one hole. The two things to be guarded against are—first, not hitting sufficiently hard, consequently sending it into the one; secondly, hitting it too hard and not quite full, bringing it completely back over the partition line along the centre of the board, and thus making it a dead ball.

When the player, in his first shot, has failed to hole the black ball, it remains an open question whether it is desirable to continue to play at the black with a

view of putting it in somewhere, or of commencing to play simply for the other holes either directly or off a cushion. He must, in deciding between these two courses, be guided very much by the position of the black ball.

One of the very worst places into which the black ball can get is right under the round cushion; as the effect of hitting it when in this position is generally to make it run round without going into any hole, and very often it will be found that three or four or even more balls are entirely wasted in knocking it about without any result whatever. A very good medium course to take is, to play and secure, say the seven and eight, and then to play at the black ball, and of course try and get it into the nine hole, and thereby score the eighteen all at once.

The bagatelle table has generally a quantity of small holes for scoring on each side of it, somewhat similar to a cribbage board. Each person or side has two pegs to score with, and the last peg is always the one to be moved.

The object of the game may be either to see which player or side can first reach a certain fixed score, previously arranged upon, and generally once up and down the scoring board; or a settled number of rounds may be played, that player or side winning whose score is the highest at the conclusion. When a fixed score decides the game, each side is entitled to an equal number of rounds with its opponent, so that no advantage may remain with the one first playing.

SANS EGAL.

This game is played by two persons only, who each take four balls—the one the white, the other the red—the black ball being placed on the usual spot. The first player strikes one of his balls to hit the black, and is followed by his opponent with one of his, and so on alternately. Each player counts towards his score all the balls of his own colour he is able to hole, and also the black ball if he hole it; but if he hole one of his adversary's balls, it is scored to his opponent. The player who is ahead in the first round takes the lead in the next. The game is generally 21 or 31 points.

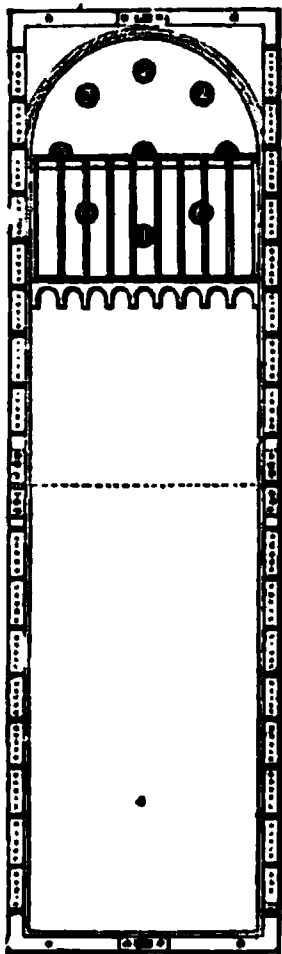


Fig. 6. — TABLE WITH MISSISSIPPI BRIDGE.

MISSISSIPPI.

This game is played with a bridge (Fig. 6), which will be generally found in all folding bagatelle-boards. This bridge contains nine holes or arches, numbered from one to nine, and it is placed as high up the table as possible over where the cups are. All the nine balls are played with, the black ball counting double or not, as agreed upon between the two players. The object is to hole the balls, but a side cushion must be struck first, or otherwise the number obtained counts to the adversary. Sometimes the black ball is placed on the ordinary spot just below the bridge, and in such case must be struck by the player before he commences to score. In both modes, however, Mississippi is inferior to the ordinary game, both in interest and science.

THE CANNON GAME.

The cannon game differs considerably from the ordinary game of bagatelle, and is far more scientific. When played on a large table, twelve or more feet long, and without any holes in it, it somewhat resembles billiards, there being but little chance in the game, the best player being sure to win. The cannon game can, however, be played on

the ordinary table containing the nine holes. Only three balls are required, viz., two white and one red, or a white, a red, and a black. If two white balls, one of them should bear a distinguishing spot, as in billiards. When playing on an ordinary bagatelle-table, it will be found more convenient to use the black ball, and for the two players to take a red and a white ball as they may decide. Then at starting the black ball is placed on its ordinary spot (*b*), and the ball of one of the players on a small spot between the five hole and the nine hole (*a*, Fig. 7).

The player can place his ball anywhere in baulk* he likes, but he must not stand at the side of the table, as, should he wish to play from the edge of the baulk, he must keep both his feet within a line with the side of the table.

The player must hit the black ball first, and a cannon is made by striking his opponent's ball with his own, after having first struck the black.

There are so many varieties of this game, which depend very often on the construction and size of the table, that it is useless to attempt to give any code of rules, which must perforce vary with the table. For instance, where the table has small pockets, the rules with regard to the scoring must of course be different to those where there are none. Should, however, the cannon game be played on an ordinary table, such as is usually found in private houses, which folds up, and which contains the usual nine cups or holes, it will be found best to allow these holes to count as in the ordinary game. For instance, should the player at starting strike the red ball and then the white, he scores two for the cannon. Should the red ball run into a hole, he scores in addition double the number of the hole, on account of its being the red ball, just as if it had been the black ball in the ordinary game. Should either or both of the white balls go into a hole, they score the number of those holes. From this it will be seen that the greatest number that can be made in one stroke is thirty-five, viz., by the red ball going into the nine, which counts eighteen, the two white balls going the one into the eight, and the other into the seven, and two for the cannon. Of course, the game played this way must necessarily contain a far greater element of chance than if only the cannons are counted. Should, therefore, two fairly good and equal players wish to test their skill, they should ignore the holes altogether. After making a cannon, the player takes his ball up off the table and replaces it anywhere he likes in baulk.

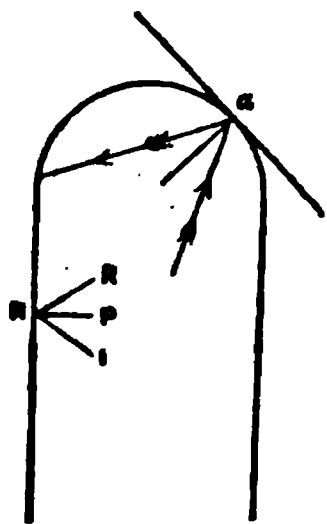


Fig. 8.

It is evident that when there is no easy cannon that can be made *directly*, there may be often one possible by striking a cushion first. For instance, it may not be easy to cause the ball to rebound from the red directly on to the white, but it may be, just as in billiards, easy to cause the ball to rebound from the red on to the cushion, and thence on to the white. Now, the secret of being a good bagatelle player is to have a thorough knowledge of the angles of the table, and in this respect bagatelle is somewhat more difficult than billiards, as in the latter game the cushions are all straight, but in the former part of the cushion is circular, and it is evidently far more difficult to judge of the direction of the ball after striking a curved cushion than after striking a straight one.

* Baulk is that part of the table nearest to the player, as far as a line drawn across the table, through the spot on which the ball is placed to start from, in the ordinary game.

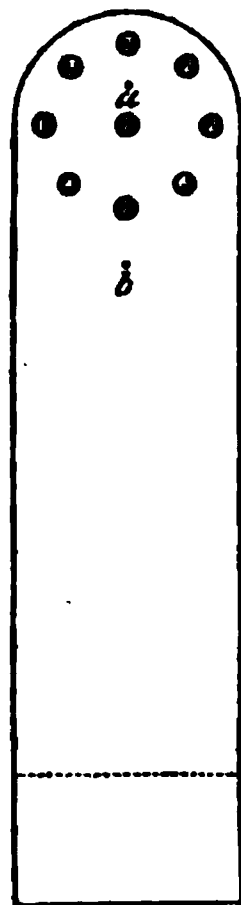


Fig. 7.

When a stroke is played gently, the angle of striking is equal to the angle of rebounding, or in more scientific language, the angle of incidence is equal to the angle of reflection. In Fig. 8 this is shown, $\angle I N P$ being the angle of incidence, and $\angle P N R$ the angle of reflection. This, then, is the great guide for the direction of the ball in every instance where the ball will strike the cushion as far as it is straight, but what will be the direction of the ball after striking the round part of the cushion? The same law holds true; but the angle must be calculated with an imaginary line drawn through the point of the cushion struck by the ball (*a*, Fig 8). By bearing this simple rule in mind, the player will be able to calculate the exact direction of the ball from any point. It will be seen from this, that if a ball played from about the centre of baulk strikes the cushion about the place where it begins to curve, or a little higher up the table, the ball will rebound very nearly in the direction of the cushion itself, and that, after again striking the cushion, it will rebound still more in the direction of the cushion; consequently, it will be found that the ball "hugs the cushion," as it is called. This is sometimes very useful to recollect. Suppose, for instance, the white ball is touching the cushion somewhere about the eight hole; by cannoning off the red, should it be low down on the right-hand side of the table, on to a spot on the circular cushion near the seven hole, the white ball will be certain to run round the cushion, and cannon on to the other white ball. This stroke, which looks very difficult, and is very effective, is in reality a very easy one. Of course, in all these strokes, it is taken for granted that the ball is struck in the centre, as, should there be any "side" on the ball, the ball will rebound from the cushion at an entirely different angle to that which it would make were no "side" to exist.

Players on small bagatelle boards, where the balls are also necessarily small, would do well always to avoid putting on "side," as in all probability the only effect would be that they either miss the ball altogether, or cause it to run in some eccentric line. Where the balls, however, are large, and the cue fitted with a good leathern tip, "side" will be often found exceedingly useful; but it should never be forgotten, when it is intended to put on "side" or "screw," always to chalk the cue first.

BILLIARDS.

THAT a game called Billiards is of ancient origin there is no doubt; Shakspeare even mentions it as being played B.C. 30; but that any game resembling the modern one of the name existed at that period is very doubtful. It has been known in England for about 300 years; recent improvements have, however, so changed its character that, practically speaking, it may be considered almost a game of modern date; and as these pages are intended to be of a practical character, we will not enter into a discussion as to what country or to what individual we are originally indebted for its invention.

THE TABLE AND IMPLEMENTS.

The slate bed of a full-sized billiard-table measures 12 ft. by 6 ft. 2 in., and as an allowance of 2 in. in width must be made for the projection of the cushions, the *playable* bed of a table is 11 ft. 8 in. in length by 5 ft. 10 in. in width, and consequently is double as long as it is wide; and it may be as well to bear in mind that it consists of two squares, exactly equal, joined together, each side of

* Full explanation of what is meant by "side" and "screw" is given on page 337.

the squares being 5 ft. 10 in. in length. This is occasionally a guide in judging the angles.

The first diagram (Fig. 1) represents the bed of an ordinary full-sized billiard-table. A is the right-hand top pocket; B the left-hand top pocket; C the right-hand side pocket; D the left-hand side pocket; E the right-hand bottom pocket; and F the left-hand bottom pocket. The average size of a pocket—i.e., its width at the fall—is from $3\frac{1}{4}$ to $3\frac{1}{2}$ inches. Some pockets are easier than others, not only on account of their greater width, but also on account of the varying shape of the cushions at the edge.

The cushion between the two top pockets is called the top cushion.

The cushions between the right-hand top pocket and the right-hand bottom pocket are called the right-hand cushions.

The cushions between the left-hand top pocket and the left-hand bottom pocket are called the left-hand cushions.

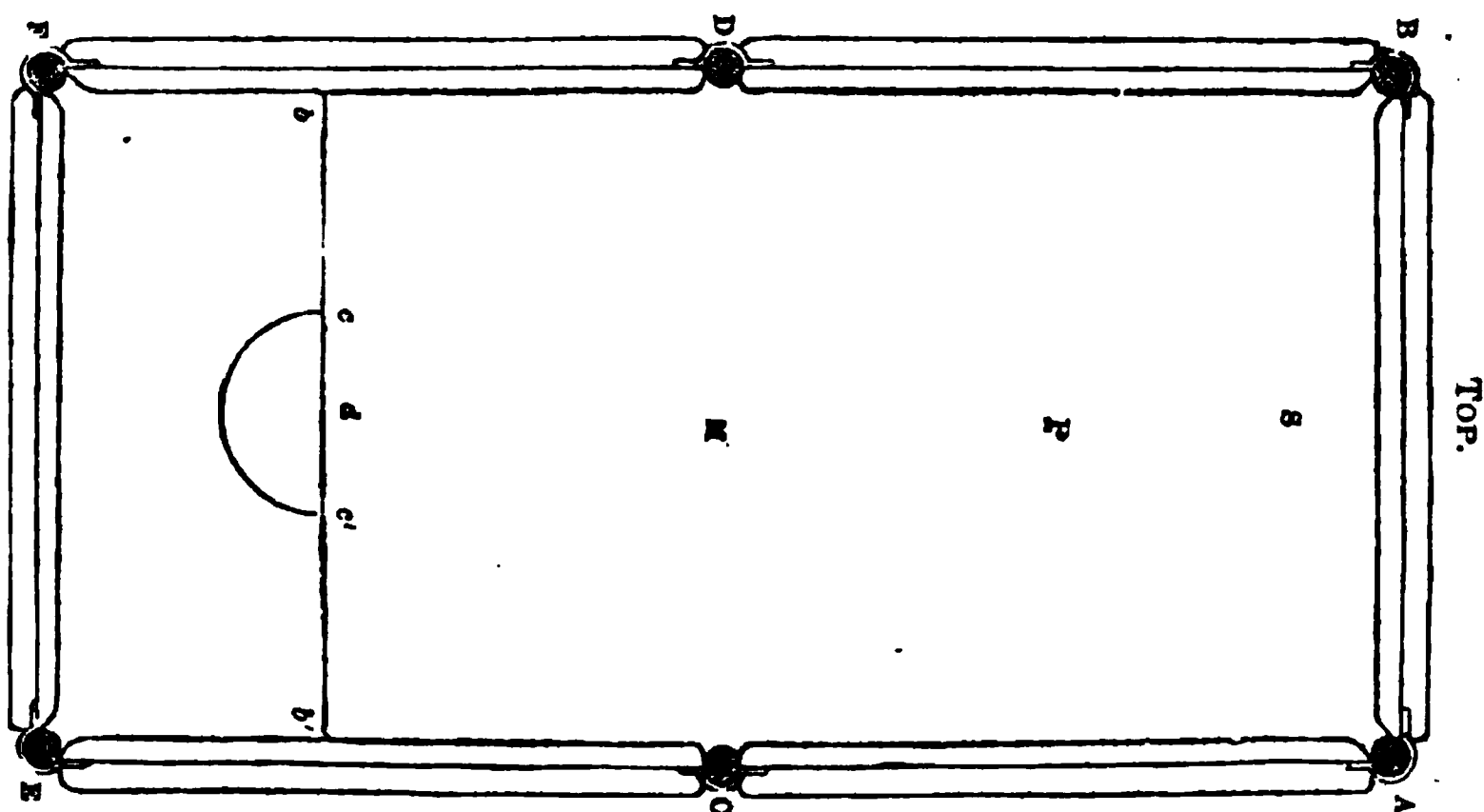


Fig. 1.—DIAGRAM OF A BILLIARD TABLE.

The cushion between the right-hand and left-hand bottom pockets is called the bottom cushion.

The line $b b'$, called the *baulk line*, is drawn (between two marks let into the woodwork) on the cloth of the table, parallel with the bottom cushion, and at a distance from the face of it, varying on different tables from $28\frac{1}{2}$ to 30 inches.

The space between this line $b b'$ and the bottom cushion is called *baulk*.

The centre (d) of the baulk line $b b'$ is the centre spot in baulk.

With the centre d , and at the distance $d c$, along the baulk line $b b'$, describe a semicircle on the baulk side of the line, cutting the line $b b'$ in the point c' . This semicircle is called the *baulk circle*. The distance $c c'$ varies on different tables from 20 to 23 inches.

The spots c' and c are called respectively the right-hand spot in baulk and the left-hand spot in baulk. All other spots are in the centre line of the table, parallel with its length.

The spot s is $12\frac{1}{4}$ in. from the top cushion, and is generally called "the spot."

The spot M , exactly in the centre of the table between the two middle pockets, is called the "centre spot."

The spot P , midway between the centre spot and the top cushion, is called

the "pyramid spot," owing to its being principally used in a game called *pyramids*.

The game of billiards is played with three balls, one red and two white. The balls are $2\frac{1}{8}$ inches in diameter, and weigh about $4\frac{1}{2}$ ounces. It is of great importance, however, that in the same set of balls all should be of exactly equal weight.

The red ball, at the commencement of the game, is placed on the spot (s), and each of the two players takes one white ball, which are distinguished from each other by one of them being marked with a small black spot, and called consequently the "spot ball."

Each player starts from the baulk circle, and strikes his ball with a long ash stick called a *cue*.

The length of a cue varies with the height of the striker, from about 4 feet 6 inches to 5 feet. A tall boy with a long reach would require one rather longer than a short boy with a small reach.

The diameter of the cue in the butt is about $2\frac{1}{4}$ inches, and gradually tapers down to a point. The diameter of the cue at the point is generally about half an inch, or rather less. Beginners should avoid playing with a cue with too small a point; three-eighths of an inch is quite small enough.

To the point of the cue is fixed the leathern top. The tops now used are almost universally the French ones, and are sold in boxes containing many of different sizes. In topping cues, great care should be taken to select a top the exact size of the point of the cue; and in fixing them the same principles apply as in veneering—both the top and the top of the cue should be made hot; the top of the cue should be made perfectly *flat*, but not too smooth (just as in veneering a toothing plane is used); the cement or glue—we prefer the latter—should be applied very hot, and the top well pressed down. The reason why the cue and top should be made hot is that, as heat expands the cue, on cooling, the cement or glue is to a slight extent drawn into the minute air-holes on the surface of the cue and top, causing them to adhere more closely.

It sometimes happens that, on a large table, the ball is so far away from the striker that he is unable to rest the cue on his hand in the ordinary way. To remedy the difficulty an artificial rest is used. It consists of a curved piece of wood or ivory (or sometimes of two pieces of wood or ivory crossed diagonally) fastened to the end of a light stick. This "rest" is very commonly called the "jigger." A longer "rest," and a long cue called the "half-butt," for use when the ball is at the extreme end of the table, together with a scoring board, complete the list of paraphernalia.

EXPLANATION OF TERMS.

A *losing hazard* is when the striker pockets his own ball after having with it struck another ball. A losing hazard off the red ball scores 3; and off the white ball, 2.

A *winning hazard* is when the striker with his own ball pockets another ball. Should he pocket the red, he scores 3, and should he pocket the other white ball, he scores 2. Should he pocket both the red and his adversary's ball, the two winning hazards score 5.

The origin of the terms "winning" and "losing" hazards is that, in the game as played many years ago, only winning hazards scored; and whenever the player pocketed his own ball it was scored against him, he losing thereby; hence the expression "losing hazard."

A *cannon* is when the player causes his own ball to strike both the other balls; this scores 2.

The origin of the term cannon is evidently from the French game *Carambole*,

in which winning hazards were called caramboles, and cannons, caroms. It was to this game that we referred when speaking of the terms winning and losing hazards.

Side is a rotatory motion of the ball on an axis perpendicular to the table, causing it to rebound from the cushion at an angle different to that at which it would rebound had no rotatory motion existed. *Side* can be put on to a ball at will, by striking it on either side of the centre of the ball in a horizontal line with that centre.

In speaking of striking a ball in certain points we suppose the face of the sphere presented to the eye to be *flat*; of course, mathematically speaking, the centre of the ball is inside, coincident with its centre of gravity.

Screw and *drag* are rotary motions of the ball on a horizontal axis in a direction contrary to that in which the ball is travelling, and are caused by striking the ball on a point below its centre, in a line perpendicular to the table that passes through that centre.

The difference between *screw* and *drag* is that the screw is intended to affect the motion of the ball after impact with the object ball, and that drag is intended to affect the motion of the ball before impact.

A screw always has a peculiar interest to beginners, who look upon the stroke somewhat in the light of a conjuring trick: a few words of explanation, therefore, may not be out of place.

First of all it must be borne in mind that a ball does not always *roll*, but rather slides along the surface of the table. Perhaps the best illustration, and at the same time explanation, of the phenomenon of a ball running up the table, striking another ball, and then running back again, would be the case of a railway engine at full speed when the driver, anticipating a collision, has reversed his engine. The action of the large wheel would be exactly similar to that of a billiard-ball under the influence of screw, viz., it would be travelling very fast in one direction, and revolving very fast in a contrary direction. The collision takes place, and directly the momentum of the engine or ball is checked, the engine or ball instantly commences to run backwards. In cases of railway collisions where the engines have been reversed this is actually what happens. Of course this rotatory motion has the effect of retarding the ball in its progress: this is very evident in the case of drag put on to a ball by a good player; the ball will be observed to go *suddenly* slower; similarly the effect of reversing an engine is to stop the train.

The *bridge* (see illustration of position in Bagatelle, page 330) is an important part of position. It is evident that unless the bridge be steady the stroke cannot be depended upon, as any movement of the bridge after a player has taken his aim would cause him to strike his ball in some point other than that intended.

In order to form a good bridge, place the left hand upon the table with the fingers touching each other, raise the knuckles so as to form a hollow under the palm, raise the thumb so as to form a groove between it and the adjoining knuckle, in which the cue may rest. The pressure on the table must be only on the tips of the fingers, especially the forefinger, and that part of the wrist that might be called the root of the thumb.

It will be found, after a week or two's practice, that a beginner will be able to raise his thumb higher than he did at first, thus forming a better groove.

PRACTICAL DIRECTIONS.

We have now sufficiently explained the different terms employed in the game to commence to give beginners some practical directions, by following which they may ultimately become good players.

The first thing a beginner has to learn is to strike his own ball properly, and in order to do this great care must be taken to acquire an easy position (Fig. 2).

The position in which a player stands is a matter of very great importance, especially to novices, as, if they once get into a habit of standing badly they will find it a very hard matter to correct it. Suppose a player to be about to make an ordinary stroke for instance, about to play from the centre of baulk, where he can reach his own ball with ease—the proper position which he should occupy is as follows:—The player should stand with his left foot advanced, the toe of which should be about in a line with the edge of the table. He should stand firmly on his right leg, which should be quite straight, while the left leg should be slightly

bent. The body should be inclined forward so that the left hand can rest with ease on the table. The ball must be exactly in front of the player, in a line with the direction in which he intends to strike it.

It is a very common fault of beginners, and also often of fairly good players, to move too quickly after striking; the very instant they have delivered the cue they jerk their body, and the unconscious preparation for this jerk will often be the cause of their missing their stroke.

It would be a good thing for them to acquire the habit of standing perfectly still after having made a stroke, not only long enough to see if they have scored, but also long enough to see if they have obtained position for the following stroke—e.g., suppose an inexperienced player has, playing from

Fig. 2.—THE POSITION.

baulk, made a losing hazard into one of the middle pockets, as a rule, the moment the ball drops into the pocket he runs round to get it out. A good player remains quiet, with his cue resting on the bridge, after the ball has been pocketed, and keeps his eye on the other ball, to see if he has obtained right strength to bring it down again over the middle pocket.

In fact, generally, it may be considered a good maxim never to move either body or cue after making a stroke until the stroke is finished, bearing in mind that a stroke is never finished until not only the hazard or cannon has been made, but the balls left in that position intended by the striker.

In taking aim great care should be taken to ultimately strike the ball in the spot aimed at. The distance between the bridge and the ball should be about six inches. It will often be noticed in bad players of long standing that although they apparently take aim very well, yet when they bring back the cue for the last time in order to strike, they bring it back in quite a different manner to

what they had done whilst aiming—generally not nearly so far back—and consequently the stroke degenerates into a sort of awkward push.

Another important point in striking and aiming is to keep the cue horizontal. We have sometimes heard a bad player remark, "How these balls jump!" most probably quite ignorant of the fact that by raising the right hand and striking down pretty hard, any good player can at will make the ball jump off the table every stroke he makes.

The direction of the eye in striking is another important consideration. In the act of striking, of course the eye should rest on the *object ball*, previous care having been taken whilst aiming to insure hitting one's own ball in the point intended.

It is often a difficult point to decide when it is absolutely necessary to use the rest. We have hitherto, in speaking of striking the ball, taken for granted that it is sufficiently near to the player to enable him to use the ordinary bridge made with the hand; but when this is not the case it is necessary to have recourse to the contrivance called the "rest" or "jigger" (Fig. 3).

Mr. Bennett has some good directions on this point. He says, "In using the rest its head should be placed on the table about the same distance from the ball as the bridge, or a little farther. The hand holding the rest is to be on the table, with the knuckles downward. The rest should be held slightly to the left of the cue, say four inches. The cue-butt is to be held between the first finger and the thumb, the thumb being under the cue, which should be raised about a foot off the table. The

Fig. 3.—Using the "Rest"

hand should be on the same level with the elbow. The arm should work from the elbow, the shoulder being kept stiff; and the hand should work under the chin. The feet should be two or three feet apart, and both at an equal distance from the table."

We are upon the whole inclined to agree with this, with the exception, perhaps, of holding the rest with the knuckles downward, which is a point we consider at the least immaterial, the generality of players keeping the knuckles up. A more important point is to keep the cue as far as possible *horizontal*. Many in using the rest strike the ball too low; this is to be avoided except in screwing, when of course it is necessary, in which case the head of the rest should be brought nearer the ball.

Another point we would warn beginners about is that, as a rule, in practising all they think about is *making a score*, and it is on this account that we would

recommend them to commence practising with one ball only. It will almost invariably be found to be the case that when any one is "knocking the balls about" for practice, that the sole object of the striker is to make either a hazard or a cannon, and that, if anything, he thinks less rather than more about "position" than when playing a game. A bad player, too, in his eagerness to play, or rather to *score*, will be often observed not even to wait till both balls have done rolling before playing again.

This sort of practice is, of course, worse than useless. Let a learner therefore take one ball, and, before striking, mark with a piece of chalk any spot on the cushion, and ask himself the question, "If I play at that spot where will my ball go?" By this means he at any rate will begin to have some idea of what is called the angles of the table.

For instance (*see Fig. 4*), let him spot his own ball on the centre spot in baulk *d*, and, by playing a little above one of the middle pockets, let him try to run a coup, by sending his ball all round the table into one of the bottom pockets.

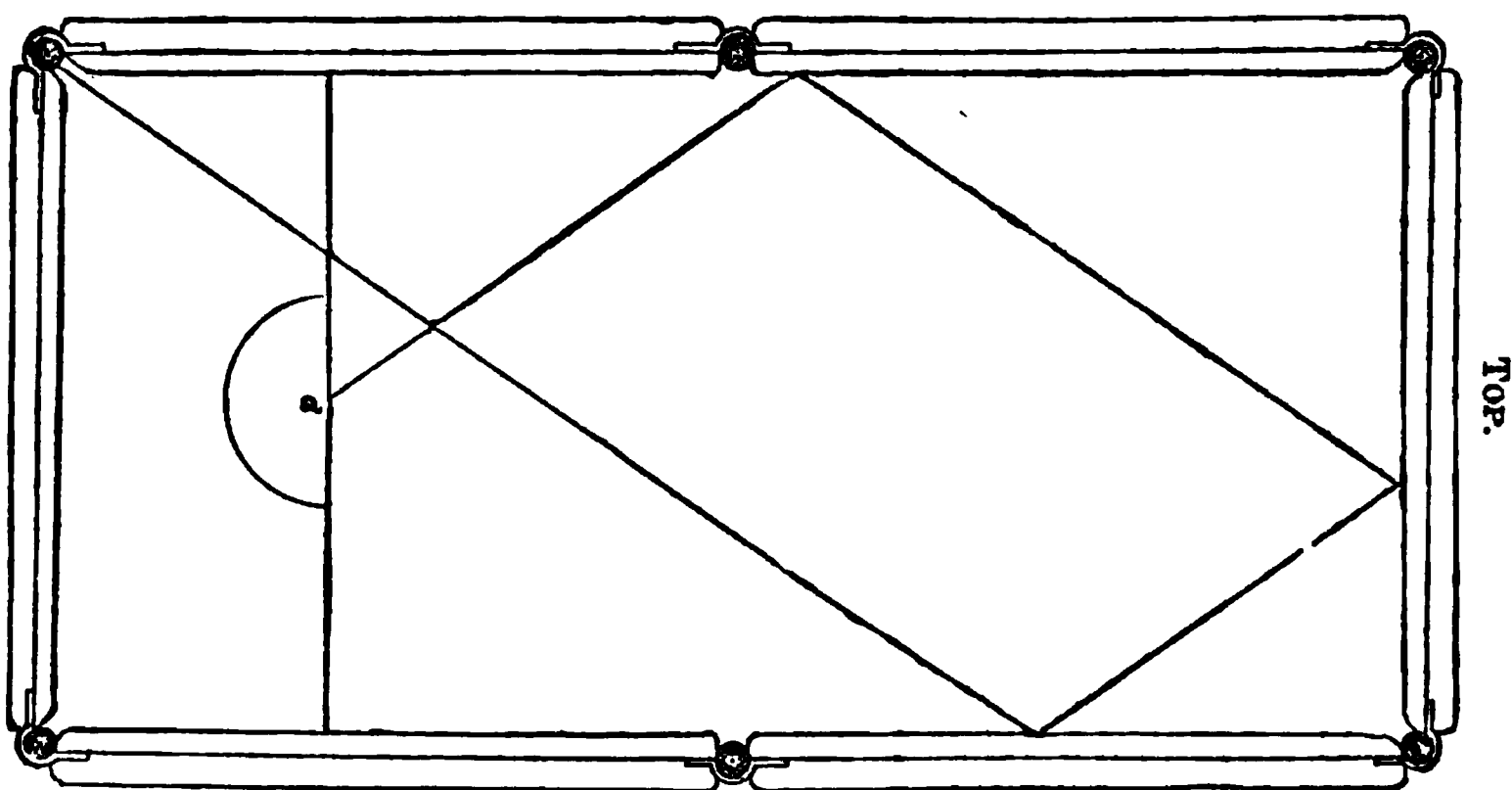


Fig 4.

This one stroke will teach him, perhaps for the first time, many things about the game that he did not know before. His first impression probably will be, "What a capital stroke this would be if both the other balls were in baulk near each other, over one of the bottom pockets; I should very likely make a cannon, or knock one of them into the pocket." But by trying the stroke over several times he will see that different degrees of strength cause the ball to rebound from the cushion at different angles. Thus (*see Fig. 5*), suppose he plays from the centre spot in baulk (very slowly) at the point in the left-hand side cushion marked *P*, the ball will rebound in the direction *P B*; but if he plays (of course, in both cases, without putting on any side) with some considerable amount of strength, the ball will rebound in the direction *P B'*.

It has often been laid down as a maxim in billiards that the angle of incidence is equal to the angle of reflection; this is, however, never absolutely the case, the nearest approach to it being when the ball strikes the cushion with such a small amount of force as to scarcely rebound at all.

If the ball be struck very slowly, the angle of reflection is very nearly equal to the angle of incidence. If the ball be struck hard the angle of reflection is less than the angle of incidence.

Thus, in the case we have mentioned (see Fig. 5), the angle of incidence $\angle P N$ is the same in both cases, but the angle of reflection when the ball was struck

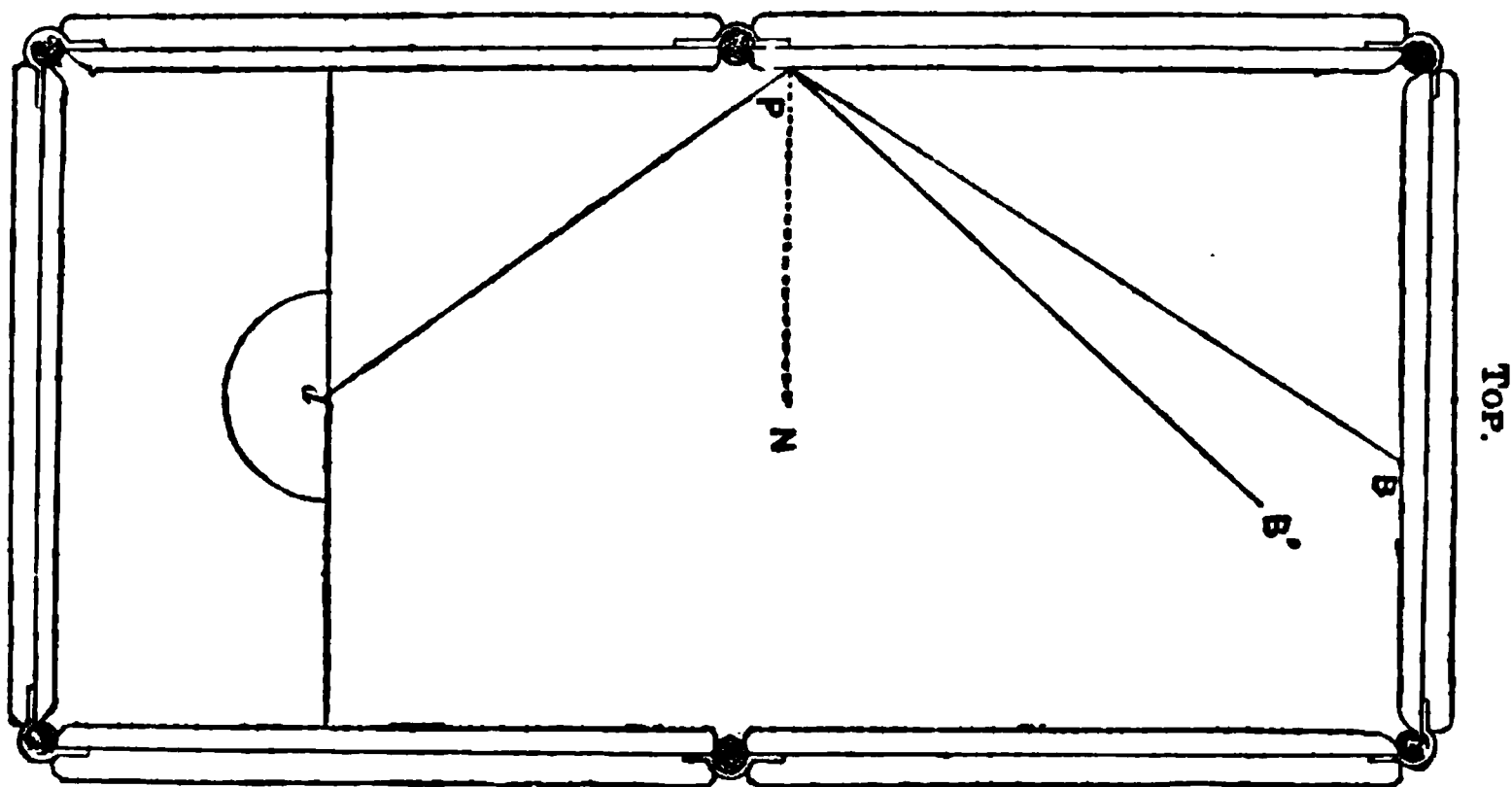


Fig. 5.

gently, viz., $\angle B P N$, is considerably greater than the angle of reflection, $\angle B' P N$, when the ball was struck with force. It is somewhat strange that many who have played billiards for years are ignorant of this and many other facts which are in reality first principles. It is we believe mainly owing to their concentrating as a rule their whole attention on making a score, and it is on this account we would recommend them occasionally to play with only one ball.

Let any player take a ball and play a stroke gently up the table, striking

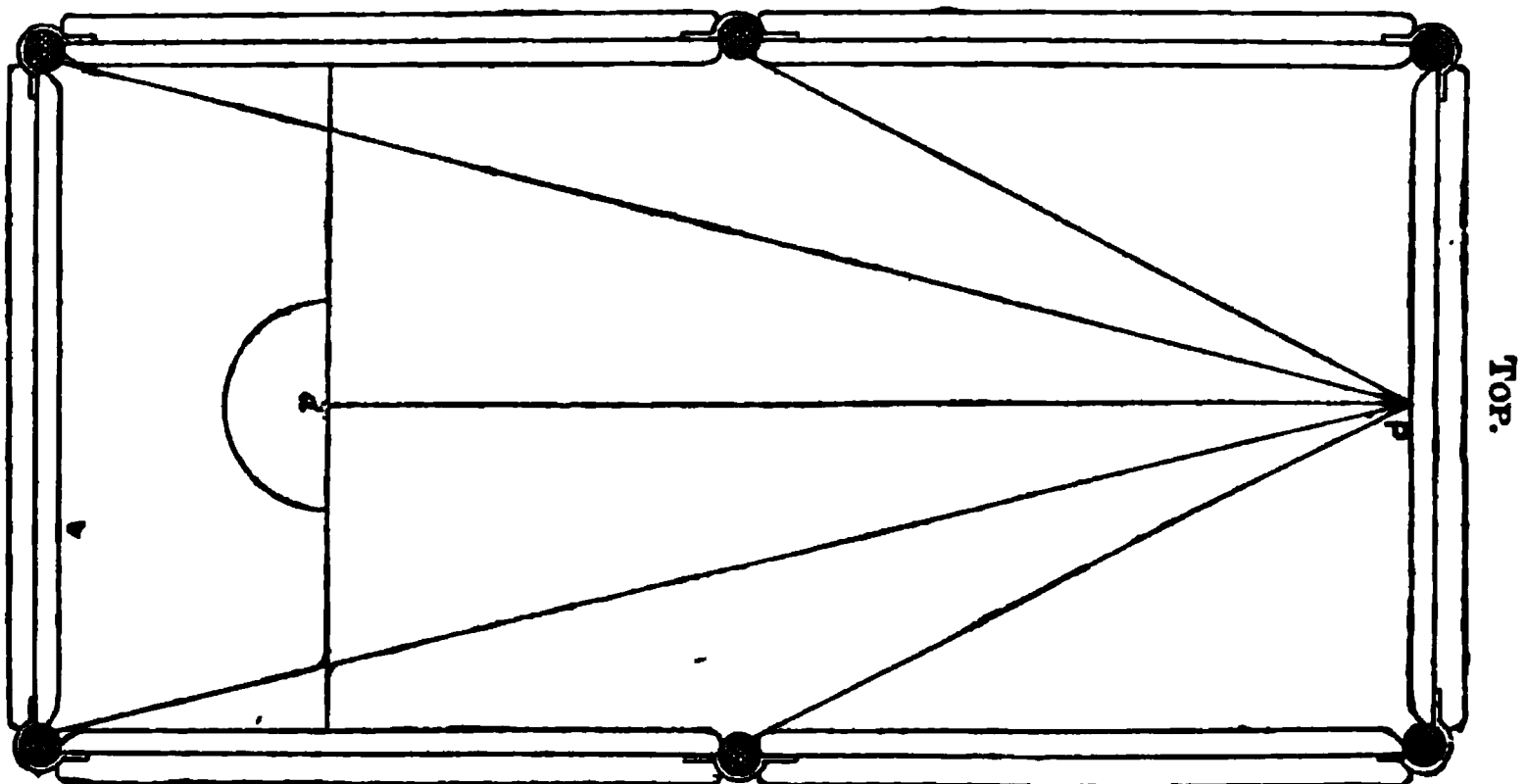


Fig. 6.

any spot on the top cushion (previously marked) with just sufficient strength to bring his ball back again into baulk. Let him observe carefully the angle at which the ball rebounds, and let him try his same stroke again with the same strength. In all probability he will find that the ball rebounds at a somewhat

different angle. He will now have ocular demonstration that he has not yet learnt to hit his own ball properly, and that he puts on side involuntarily. Should a somewhat good player attempt it, and fairly succeed, let him try and hit his ball with sufficient strength to send it up and down the table five times. Even the best of players cannot do this without putting on a little side unconsciously. It will be found very good practice for a beginner to regulate side, and to accustom himself to put on a small or large amount at will.

Let him play from the centre of baulk (*d*, Fig. 6) and play at a spot, *P*, in a line with the spot, and try first to bring his ball back straight, secondly, to put on just sufficient side to bring the ball back, as shown in the diagram, first into or towards the right and left bottom pockets, and afterwards into or towards the right and left middle pockets.

With a view to regulate side, the beginner has been recommended to practise with one ball only if he wished to see fully the effect of putting it on. Now, it may seem somewhat paradoxical, but it is, nevertheless, perfectly true, that a thorough knowledge of side and its effects is principally useful in order that it may not be put on. There are many more games lost by putting on side when it is not wanted than from side not being put on when it is.

To get the exact amount of side on, no more and no less, will be found an exceedingly difficult matter, still, by playing at a cushion, the error is apparent; by playing at another ball it is often difficult to say whether too much or too little side has been put on, as the slightest variation in the position of the spot in which the object ball is struck causes often considerable variation in the angle at which the ball flies off.

Many strokes are missed, and indeed very often the ball itself missed, from putting on side when it is not needed. Hitting a ball when tight under the cushion exemplifies this.

When we were describing how to hit the ball—a most important point in billiards—we did not mention this peculiar position, which very frequently happens, and many a game may be and is lost owing to the striker being unable to play from the fact of his ball touching the cushion. How often does one hear the common expression, “I couldn’t play, I was tight up.”

When therefore the striker’s ball is close under or even within a few inches of the cushion, it is necessary for him to form a bridge entirely different to the ordinary one, for it is evident that he cannot rest his hand on the table at all. The way to form the bridge in this case is to rest the tips of the fingers only on the woodwork of the table. Should the ball be quite close to the cushion, in order to strike it will be found necessary to raise the right shoulder and at the same time shorten the cue, *i.e.*, hold the cue nearer the tip than when playing an ordinary stroke.

It is evident that in this position the ball must of necessity be struck rather downwards, and consequently it is of the greatest importance that it be struck in the *middle*, otherwise the result is almost certain to be a miss, for if a ball be struck downwards with side on, it will travel in a curved line and not in a straight one.

LOSING HAZARDS.

The beginner having learnt to hit his ball fairly well, must first, if he wishes to become a good player, turn his attention to *losing hazards*. Losing hazards are the backbone of billiards, and all good breaks consist largely of a series of these most useful of all strokes.

We have already described a losing hazard as pocketing the striker’s ball off another one. We will suppose the balls to be left in such a position as that there

is an easy losing hazard into some pocket off, say the red ball. Now, let the striker, before making this easy stroke, think to himself for one moment about the position of the balls after the stroke which we, for sake of example, have supposed to be so easy that it cannot possibly be missed. The position of his own ball is certain, i.e., he will have the choice of placing it anywhere in the baulk circle. But where will the red ball be? This entirely depends upon how he plays his stroke. Of course he should try and leave it in such a position that another easy stroke will be left next time. This is what is called "playing for position," and it is upon the amount of thought and attention given to it that progress in learning the game depends. But before we enter fully into the important subject of position play we will explain how to make losing hazards.

There is one angle at which it is easier to make a losing hazard than at any other, and it is of great importance that the player should accustom his eye to this particular angle, so that he may know, when playing from baulk for a losing hazard, how properly to spot his ball in the right place.

Beginners will notice, if they watch good players making a break, that when-

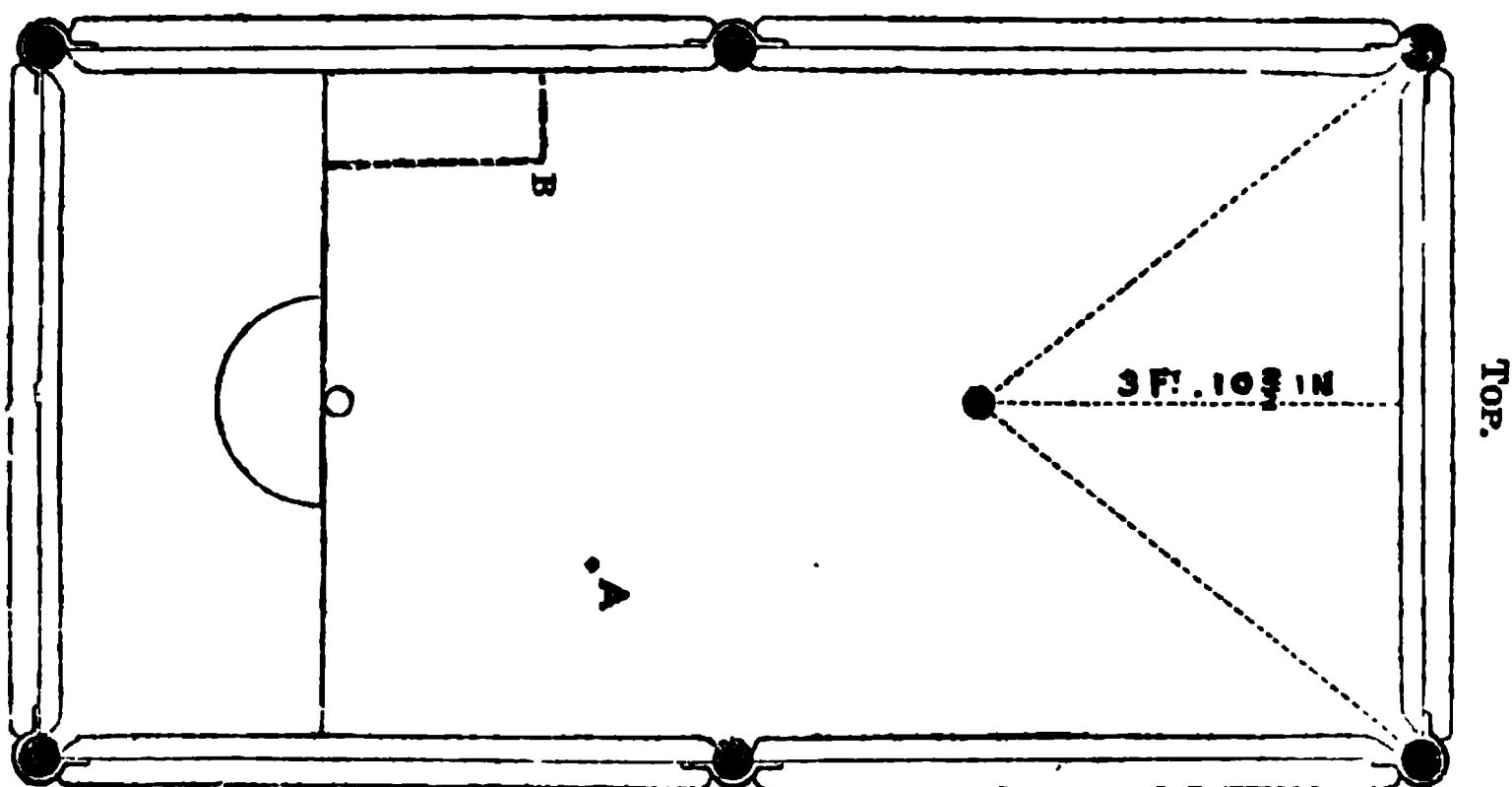


Fig. 7.

ever they play from baulk they are very particular as to the exact spot on which they place their ball, and that often after placing it they will cast their eyes to the object ball and then move their own ball sometimes not more than an eighth of an inch; yet this care is necessary, and it will be generally found that the better the player the more particular he is about placing his ball. What angle, then, is the easiest at which to make a losing hazard? Place the white ball (Fig. 7) on the centre spot in the baulk line, and the red ball on the centre line of the table, 3 feet 10 $\frac{3}{4}$ in. from the top cushion. The balls are now placed in the position in which an easy hazard is possible off the red ball into either of the top pockets, and it will be found that a losing hazard is easier at this particular angle than at any other, and consequently the beginner should try to accustom his eye to this angle, so that in playing he may be able so to spot his ball in baulk that it may make this angle with the object ball into any pocket for which he may be playing.

It must be borne in mind that we are presuming that the table is a full-sized one, i.e., 12 ft. by 6 ft. 2 in., allowing 2 in. for the cushions, or, 11 ft. 8 in. by 5 ft. 10 in., or, as has been already seen, two perfect squares of 5 ft. 10 in. each joined together.

The measurement of 3 ft. 10 $\frac{3}{4}$ in. from the top cushion is exactly two-thirds

of one of the sides of the squares. Should, therefore, any of our readers try the stroke we have mentioned on any but a full-sized table, they must not measure 3 ft. 10 $\frac{1}{4}$ in. from the top cushion, but first measure the side of one of the two squares of which every symmetrical billiard-table is composed (one above and one below a line joining the two middle pockets), and then measure two-thirds of that side from the face of the top cushion, down the centre of the table, in order to obtain the correct spot on which to place the red ball, as in Fig. 7. In all the diagrams the shaded ball is supposed to be the red. We would strongly recommend any beginner to practise this particular stroke till he has mastered it. The stroke, too, has the advantage of being, to a certain extent, independent of strength, and it can be played so slow that the red ball will not come down below the middle pockets; or it can be played fast enough to bring the red ball over one of the middle pockets.

The exact spot on the red ball at which to aim is the extreme edge of the object ball.

If the beginner plays first of all to hit the red ball "fine," *i.e.*, rather on the edge, he will find that the white ball rebounds and hits the top cushion; by gradually hitting the red fuller, he will find that he gets nearer and nearer to the top pocket, and will eventually make the losing hazard. He will now begin to see why this particular angle is easier than any other at which to make a losing hazard, for if he has an observant eye, he will find that though constantly making the losing hazard into the top pocket, yet that the red ball rarely comes off at the same angle.

Now it is evident that if the losing hazard into the top pocket is only possible by hitting the red ball on one spot, the red ball would strike the cushion on the same spot after every stroke. The fact, therefore, of the red ball striking the cushion on various spots, notwithstanding that the losing hazard has been made, proves that there are various spots on which the red ball may be struck, from each of which the white ball will rebound and run into the pocket.

Now, a stroke being easy depends upon the number of spots on which it is possible to hit the object ball, and yet to make the stroke. For instance, the easiest stroke on the table would be to knock a ball which hangs so much over the pocket that if it be struck at all it must go in. On the other hand, the most difficult stroke would be to knock a ball into a pocket when it is so placed that there is but one spot on which it may be struck by another ball to cause it to go in—as for instance, to cut a ball placed on the centre spot of the table into one of the middle pockets from the centre spot in baulk. This stroke is so difficult, that it may be said to be the limit of what is possible.

Hitherto, in speaking of making losing hazards, we have of course taken for granted that the striker has struck his own ball fairly in the centre, as otherwise the stroke we have named will not be made so easily. No side should be put on, as a rule, in making losing hazards, as the ball under the influence of side is much less likely to run true.

We will now suppose the beginner to have practised the stroke given in Fig. 7 sufficiently to be able to make it, as a rule, at least twice out of three times; if this is the case his eye will probably have sufficiently accustomed itself to the angle to enable him to vary the stroke by moving the red to some other spot a little to the right or left, when he will, of course, have to alter the position of his own ball in baulk. If he finds that he continues to make the losing hazard in the fresh position as often as he did in the previous one, he may rest assured that he has fairly learnt that most important and at the same time most difficult part of elementary billiards, *viz.*, "learning to spot his ball."

Let him now begin to try another class of losing hazards, *viz.*, those in the middle pockets. These, fortunately for the beginner, are much easier than those

into the top pockets, and consequently more encouraging, as nothing is more tedious, as we know by experience, than to be constantly failing in the stroke we are practising.

Let him then place the red ball on (*see* Fig. 7) the spot we have marked A, and playing from baulk, try and make a losing hazard into the right-hand middle pocket. Now this stroke is so easy that the beginner should try and think about "position," i.e., let him reason to himself and say, if I make the stroke, my own ball will of course be in the pocket, but where will the red ball go to?

Now in playing this hazard it is evident that the red ball will run up the table and strike the top cushion; if played hard, in all probability it will rebound and run into baulk; if struck slowly, it will not rebound perhaps beyond the centre line of the table between the two middle pockets.

What the player should endeavour to do is to avoid both these extremes of strength, and strike the red ball with just sufficient force to cause it to run up the table, strike the top cushion, and return and stop as nearly as possible in its original position, A, by which means another easy hazard is left.

This stroke is as good as any to illustrate the meaning of a "break." Some players are so good at this particular stroke, that they can make sometimes as many as twenty or thirty losing hazards running in the middle pockets alone, as, should the ball come down the table a little too much to the left, there is of course an equally easy losing hazard into the left-hand middle pocket as there was before into the right-hand one. In playing this stroke beginners must not get discouraged if they but rarely get the right strength, for they must remember that for any one to make even ten hazards running, i.e., a break of thirty, he must be a very good player.

But there are other ways of missing the stroke (and by the stroke we mean position for the red ball as well as making the losing hazard) than that of either bringing the red into baulk, or leaving it above the middle pockets in the same line as the spot A. One of the most common of these is hitting the ball too full, and causing it to return too near the side cushions, and consequently leaving no easy hazard playable into the middle pocket the next stroke.

Some losing hazards require side, but only experience will tell the player when to put it on and when not; but one important standard rule at billiards is—Do not put on side unless it is absolutely necessary for the stroke, bearing in mind that by the stroke we mean not only the score, but *position*. Now, side may be put on with two objects, viz.: 1, to alter the direction of the ball after contact with the object ball; 2, to assist the ball in going into the pocket when the latter is narrow. We will explain presently the meaning of a "narrow pocket."

We have already given instances of losing hazards into the middle pockets. Now, suppose a ball to have stopped on a spot thirty-five inches from the right-hand corner spot in baulk, along a line drawn from it parallel with the length of the table, it will be found, by placing the striker's ball on the left-hand corner spot in baulk, that there is an easy losing hazard into the middle pocket; but if the ball were an inch higher up the table, i.e., thirty-six inches from the right-hand corner spot in baulk, the losing hazard would not be so easy, and would require a hard stroke, which would probably have the effect of bringing the object ball into baulk, instead of leaving it over the middle pocket in position for another losing hazard the following stroke. The hazard is, however, rendered easy by putting on right-hand side.

Suppose the red ball to be on the spot we have mentioned, viz., thirty-six inches from the right-hand corner baulk spot. Now, if the striker plays from the left-hand corner spot in baulk, and hits his ball on the right-hand side, it will come off in one direction, and he will consequently make the hazard. But, if he were to hit his ball on the left-hand side, it would, after striking the red, come off

in another direction. By striking the ball fairly in the centre it would come off in a direction between these two.

Perhaps the best explanation of a narrow pocket is as follows:—Place any ball within an inch of the cushion half-way between the two bottom pockets, and attempt to run a coup into either of them without putting on any side. Any beginner will find out for himself that this is by no means an easy stroke; but let him now try again with side, and he will find that what before was difficult is now comparatively easy. Of course what side to put on is self-evident. The effect of side is to cause the ball to rebound from the cushion at an angle different to that at which it would rebound had no side existed.

Now, in the stroke of which we speak, viz., running a coup into a pocket, when the ball is nearly touching the cushion before entering the pocket, it is almost certain to strike the extreme end of the cushion opposite the side, therefore, what must be put on is that which will cause the ball to rebound in the direction of the pocket.

Many losing hazards require side, for the reason that the ball enters the pocket obliquely.

Now, suppose that the ball has stopped on the spot marked B in the diagram (Fig. 7), which is eleven inches from the side cushion, and twenty inches from the baulk line. The only losing hazard possible off it from baulk is one into the top corner pocket, and this hazard requires a great deal of side. In playing this stroke, as much left-hand side as possible must be put on; this side will materially assist the ball in going into the left-hand top pocket—in fact, on some easy tables it will often be observed that the ball in travelling up the table will strike the left-hand side cushion and yet afterwards go into the pocket, the side, as is often observed, taking it in.

Of course, should the ball have settled on a similar spot on the other side of the table, the hazard will be into the right-hand top pocket, when strong right-hand side must be used.

Losing hazards can be made when the ball is rather nearer to the cushion into the middle pocket, but these, which are called “jennies,” do not require so much side as many imagine; and we would recommend those really desirous of learning the game to practise those long losing hazards into the top pockets before those apparently easier ones into the middle.

An oft-recurring and consequently very useful losing hazard is when the white ball is near one of the middle pockets and the red ball on the spot. The diagram (Fig. 8) explains a few of these strokes that occur in almost every game.

Position 1 is when the white ball is in a line between the middle pocket and the red ball, which in every case is supposed to be on the spot; the white ball is also supposed to be an inch or two from the cushion. In this position there is an easy losing hazard into the right-hand top pocket, and the red ball must be struck what is called a fair half-ball, i.e., the striker must point his cue at the extreme edge of the object ball.

The red ball will of course strike the top cushion and rebound, if struck properly, down the centre of the table. In Position No 1, i.e., when the striker's ball is in a line with the middle pocket, the stroke can be played sufficiently slow to bring the red down to the spot A, thereby leaving a losing hazard next time into either of the middle pockets.

Position 2 is when the striker's ball is a little lower down the table.

In this stroke the red ball must always be struck a little fuller and a little harder; it is consequently not a true half-ball stroke. Again the red ball must be struck so as to bring it down the centre of the table. This stroke must be played with sufficient strength to bring the red ball into baulk and out again.

It must be borne in mind that the strength with which a stroke is played necessarily varies considerably with the table. Now, in the position No. 2, should the table be a very slow one, it would be possible to play the losing hazard into the top corner pocket without bringing the red into baulk. Still, on most tables that are properly brushed and ironed, the stroke should be earnest, played sufficiently hard to bring the ball into baulk and out again.

Experience alone will enable a player to thoroughly judge of the strength of a table, but, as a rule, the strokes we are now describing are more often missed by being played too slow than too hard. Care must be taken, in playing all these losing hazards, to hit the ball high, and especially to avoid putting on side.

Position 3 is when the ball is still lower down the table, some six or seven inches below the middle pocket; as in position No. 2, there is a losing hazard to be made off the red ball on the spot into the top corner pocket, and the stroke only differs from the preceding one in that it must be played considerably harder. The ball must be struck exactly in the middle, and the greatest care

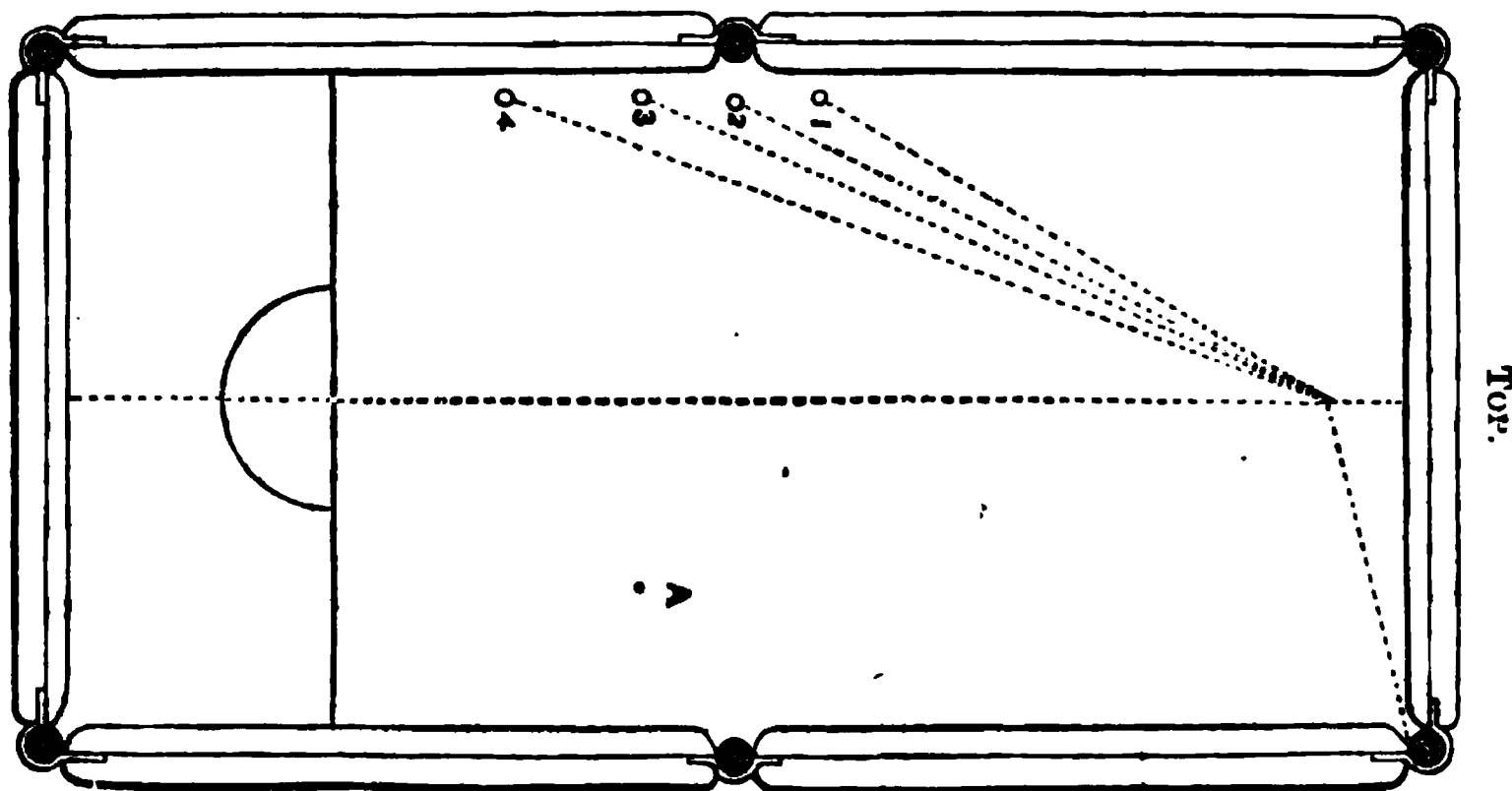


Fig. 8.

should be taken to keep the cue as horizontal as possible. The effect of raising the right hand too much would be either to screw the ball, and consequently what is called "over-do" the stroke, by causing the white ball to hit the side cushion, or to make the white ball jump off the table. The stroke is what may be called a forcing stroke, as it requires a certain amount of strength to accomplish it.

In Position 4, when the ball is half-way or more down the table, it is still more difficult to make the losing hazard into the top pocket, and as the position of the white ball approaches nearer to baulk, it is often difficult to decide when the forcing hazard ends and one requiring screw commences, the stroke necessarily varying with the state of the table, and also the state of the balls.

WINNING HAZARDS.

There is very little to be said on the subject of winning hazards, the only difficulty in making them being the extreme accuracy necessary in taking aim. When any ball is in such a position that it can be sent into a pocket in a direct line, there is always a winning hazard possible if the spot on the ball in a line with the centre of the pocket and the centre of the ball, on the opposite side of

the ball to the pocket, can be struck by the player's ball. Fig. 9, positions 1 and 2, will perhaps explain better what we mean. The red ball to be sent into

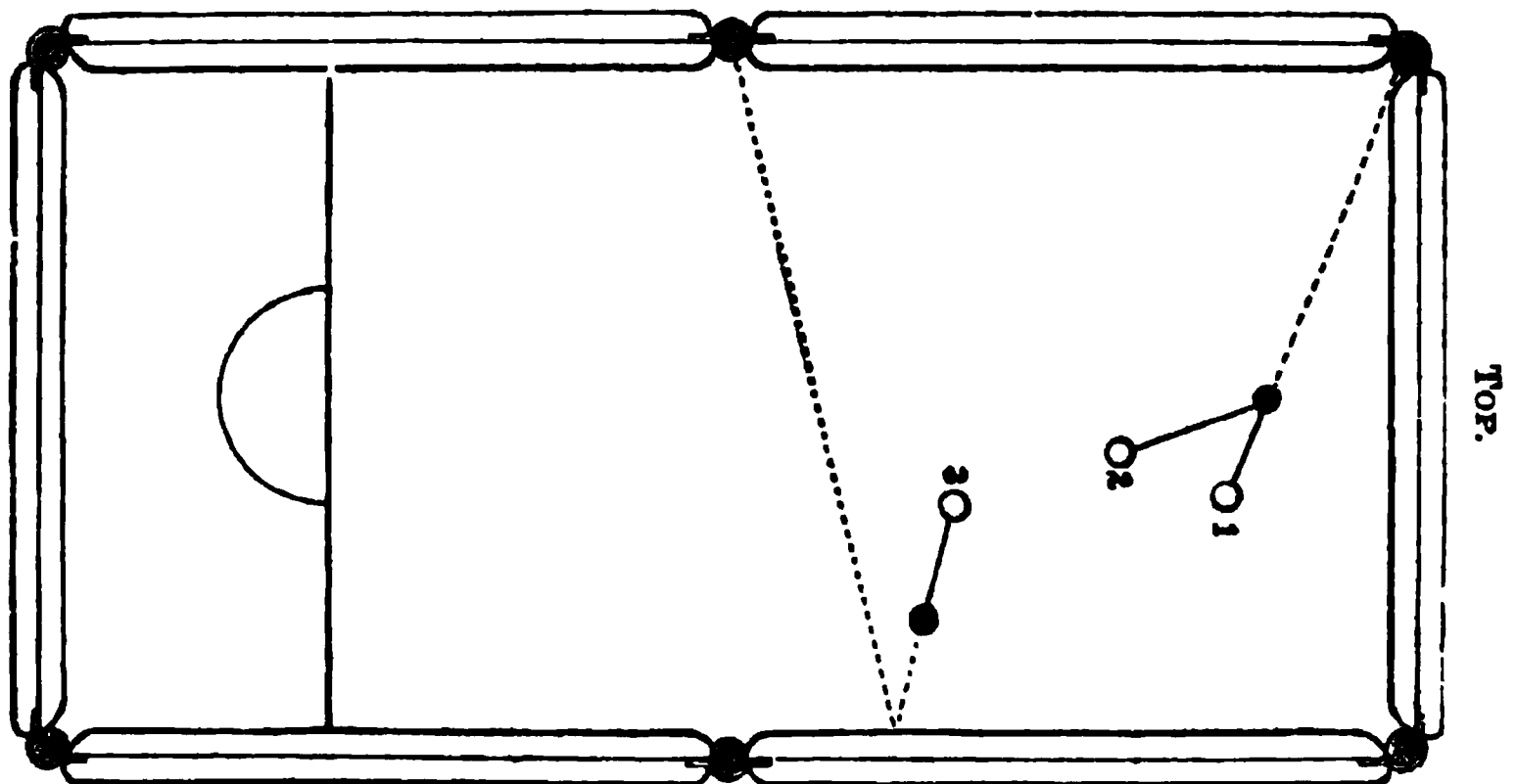


Fig. 9.

the left-hand top corner pocket must be struck on a spot in a direct line with the centre of the pocket and centre of the ball, and whatever position the white ball is in, this same spot must be struck, in order to insure making the hazard. Position 1 is what is called a straight hazard; position 2, a cut, though not a very fine one, since the limit at which it is possible to cut a ball, supposing the player's ball to travel in a straight line, is at an angle of 90° .

One variety of winning hazards is what is called a double, i.e., when the

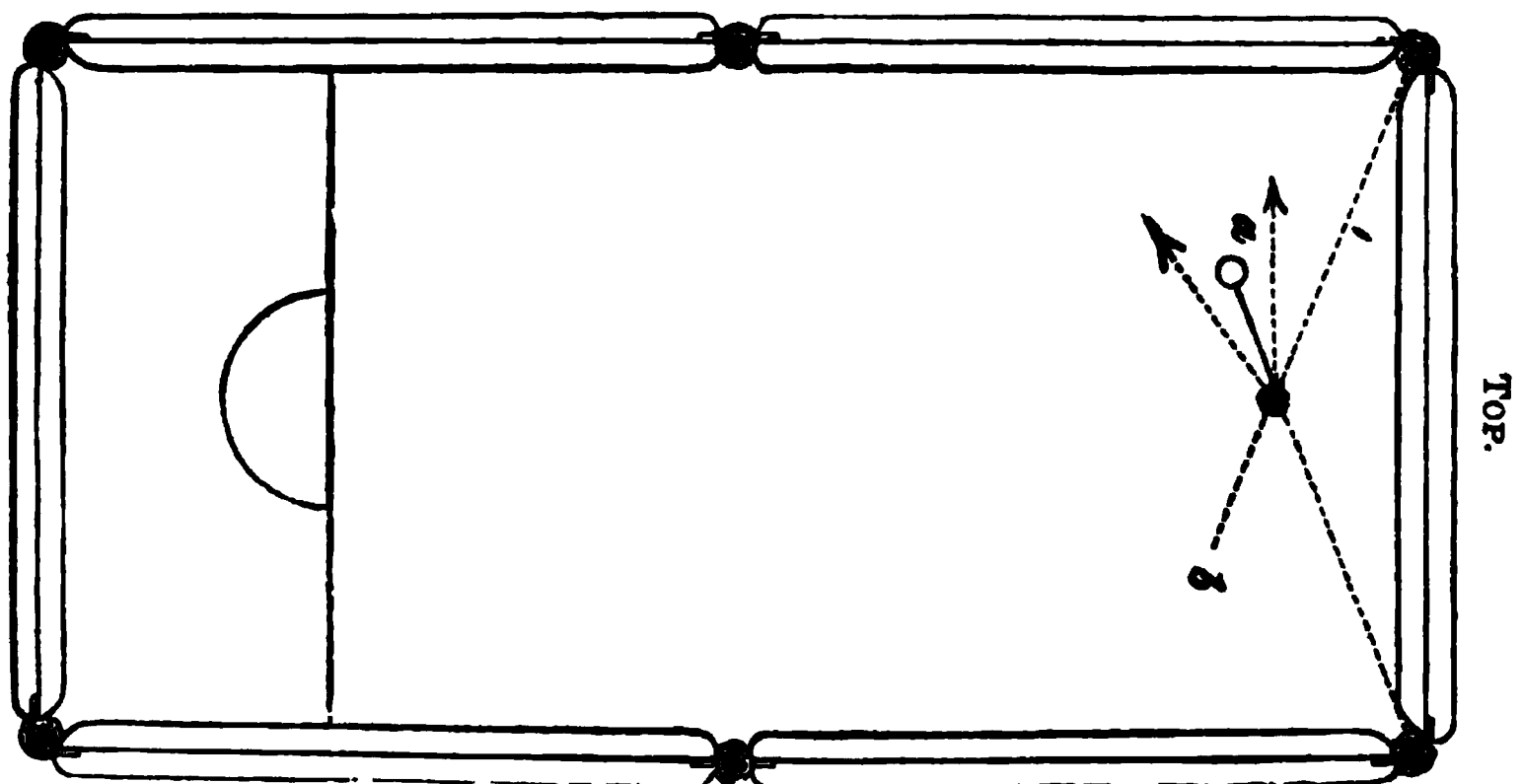


Fig. 10.

player causes the object-ball (that is, the ball he plays on) to strike a cushion before going into a pocket. Position 3 shows the balls placed so that, comparatively speaking, the red may easily be doubled into the opposite middle pocket. The

dotted line shows the direction the ball would take if the stroke were played with moderate strength; but now what will happen if the stroke be played hard? If the red ball be struck exactly in the same spot, only very hard, it will rebound

TOP.

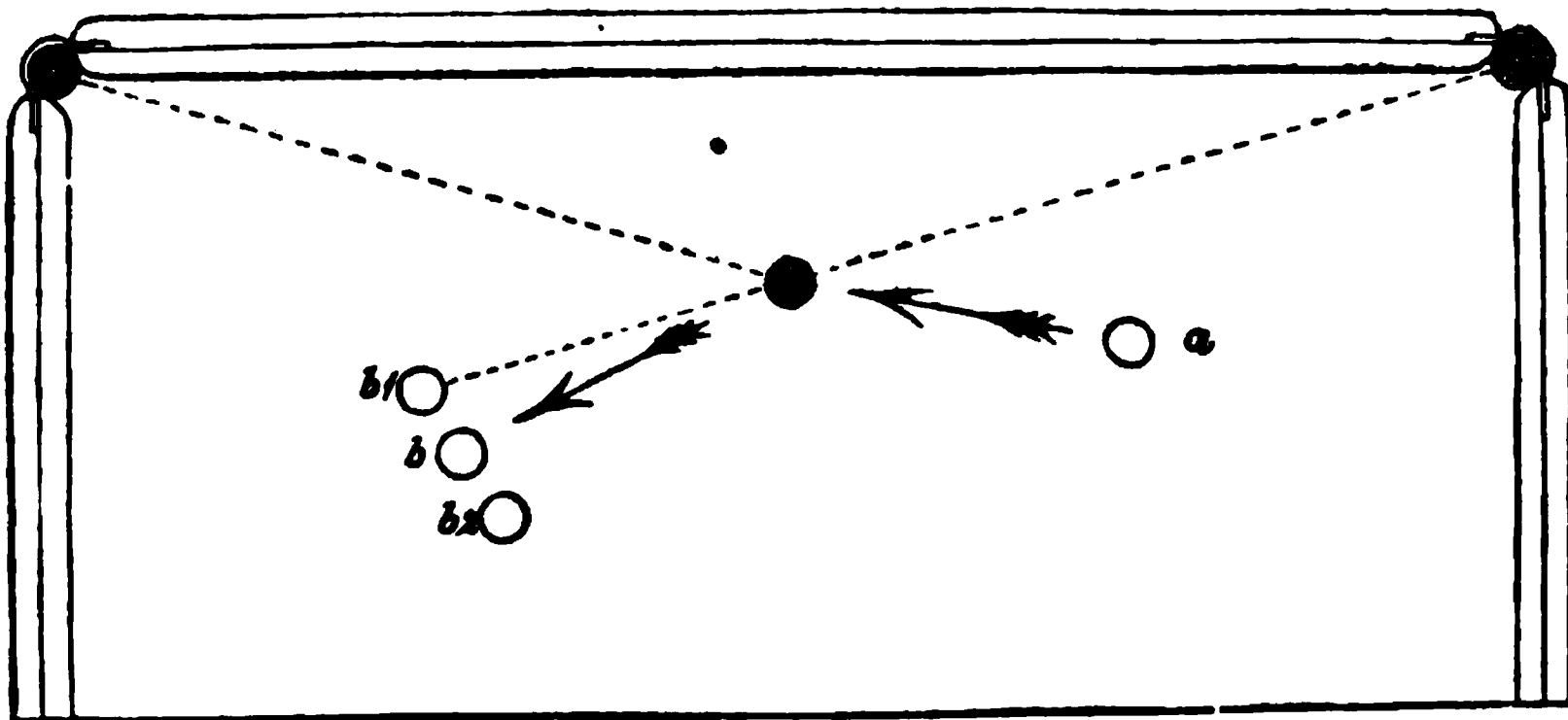


Fig. 11.

from the cushion at a different angle, and instead of entering the opposite middle pocket, it will strike the left-hand up-side cushion. The reason for this has already been explained.

Of course, in billiards by far the most important winning hazards are spot
TOP.

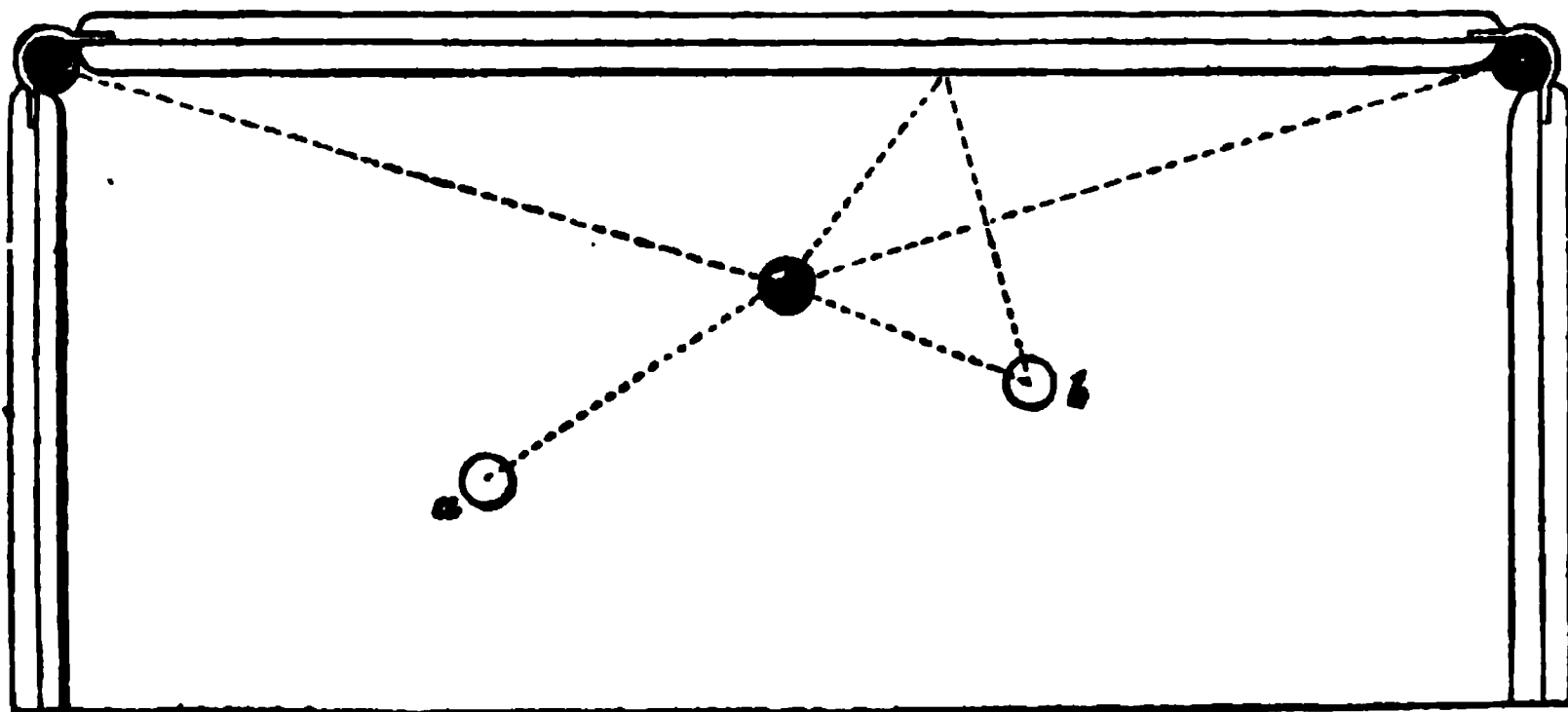


Fig. 12.

hazards. Nearly all the great breaks on record have been made by a succession of winning hazards with the red ball.

Suppose, then, the red ball is on the spot, and the white ball in a straight line with it and the top corner pocket (as in Fig. 10), it is at once evident that if the player can hit the red ball full, thereby putting it in the pocket, and, at the same time, bring his ball back by means of a screw to the same place, that the same stroke will be left over again; consequently, should at any time a player

arise who can make this stroke to a *certainty*, it will follow that when once he obtains this position he can go on scoring for ever.

Suppose the position we have shown in the diagram to have been obtained, it is inevitable that sooner or later the white ball will *return*, more or less, in the directions shown in the dotted lines terminated by the arrows. When the position first shown has been lost, what the player has to do is to hole the red, and as nearly as possible get his own ball back into the position *a*, or the corresponding position *b*, on the other side of the red ball. There are several ways of doing this, all, of course, depending upon the exact position of the white ball. First, suppose the ball is in position *a*, Fig. 11—i.e., not quite in a straight line with the red ball and the pocket, but a little nearer the top cushion—now there is an easy winning hazard left into the left-hand top pocket, of course, but where will the white ball go to afterwards? Let the player try, and he will find that it is by no means difficult to make his own ball follow on in the direction shown by the arrows in Fig. 11, so as to stop in position *b*, when, of course, he proceeds to screw back as before. If, however, he has miscalculated the position, and his ball has run into the position *b'*, then he has almost a similar stroke to the one just played, and by following through the red he can get his ball into a straight line with the red and pocket, on the other side of the red.

But suppose the white ball runs into the position marked *b'*, how is the stroke then best played, in order that position may be obtained? Fig. 12 explains perhaps the most common form of the spot-stroke, or rather the position in which ordinary amateur players mostly leave the balls. Position is best obtained by playing so as to cause the white ball to rebound off the top cushion. It will be found that, as a rule, amateurs will require a little right-hand side, or, if playing from the right-hand side of the table, a little left-hand side, otherwise the ball will come off the cushion too near the red ball, and, of course, the nearer to the red the ball is the more important is the strength; an error of an inch, a foot and a half from the red ball, is of very little moment compared to an error of an inch two inches only from the red ball—in the one case the stroke is easy, in the other nearly impossible.

CANNONS.

We now come to what is to many the most interesting part of billiards, viz., *Cannons*. It is evident that cannons are far more difficult to make well—i.e., with due consideration for position—than either losing or winning hazards, for this reason: that all three balls are of necessity moved.

Fig. 13 is an instance of a very ordinary cannon, which occurs in almost every game, which is perhaps as good an example as can be given, as the position of the balls after the stroke is very evident. The red ball is close under the top cushion, and the white ball about six inches away from the side cushion; the striker is in hand.

Now, it will be at once seen how very important an element is strength in playing this stroke; if it be played just strong enough to bring the white and red balls together, the striker will have a first-rate break left next time; but should the stroke be played too hard, and the balls separated, very probably the player will not be able to score next time at all. The small curved line off the red shows the probable direction of the striker's ball after hitting the red dead full.

Now the position in which the balls are left enables a skilled player to make, as a rule, another very easy cannon, which brings the red ball over one or the other of the top pockets, when, on the following stroke, it can be put in, and the spot stroke obtained.

Fig. 14 gives two more specimens of cannons, one a very common one, as it:

frequently occurs the second stroke in every game, especially among rather inferior players, who do not play with sufficient knowledge of strength properly to give a miss in baulk at starting.

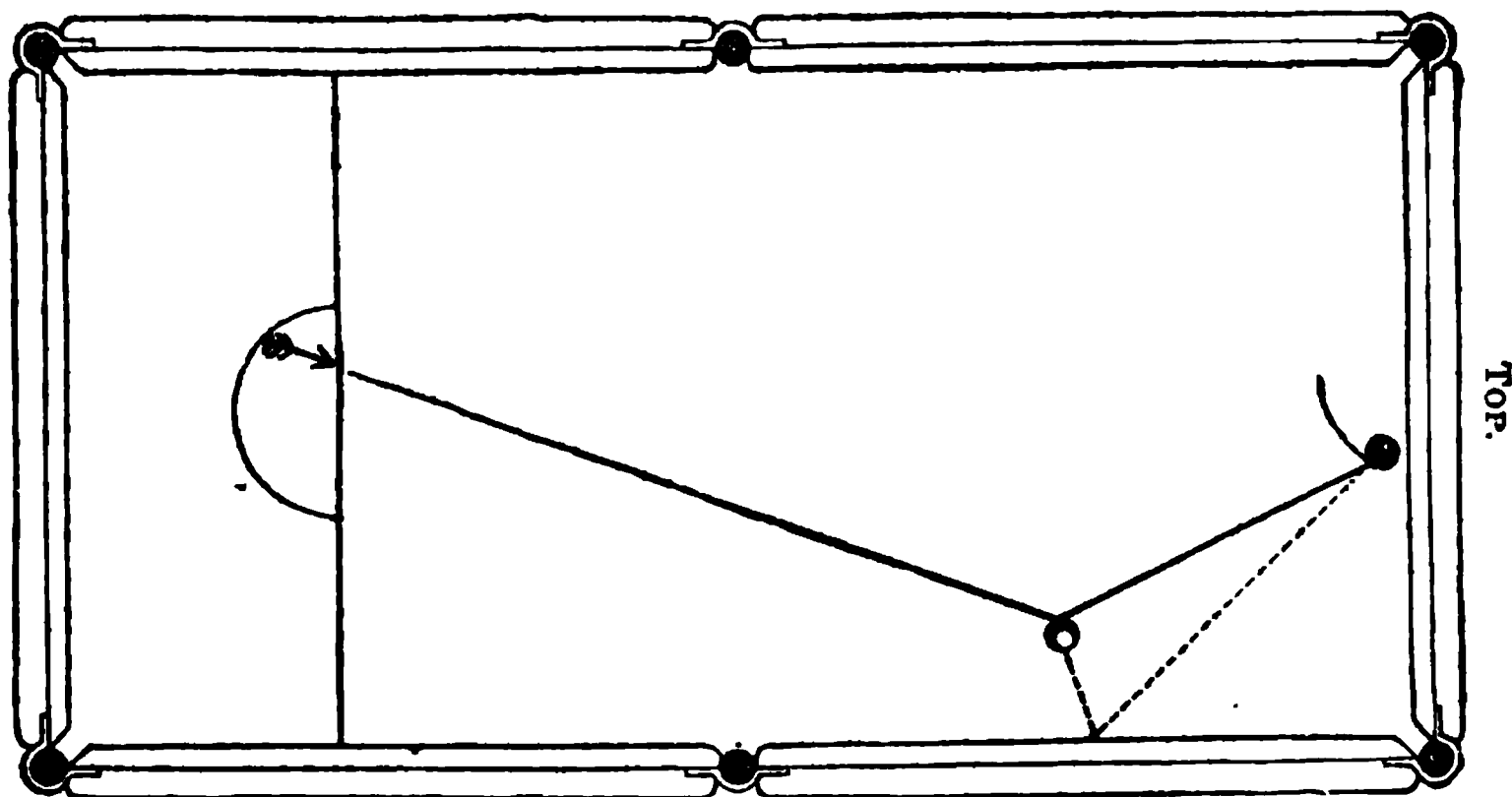


Fig. 13.

It will often be observed that at the commencement of the game a player, instead of leaving his ball in baulk in the semicircle, as he should do, will play the stroke too hard, and bring his ball over one of the bottom pockets. In this case his opponent should play for the cannon all round the table, as it is called. The ruled lines in Fig. 14 represent the cannon in question; the dotted lines

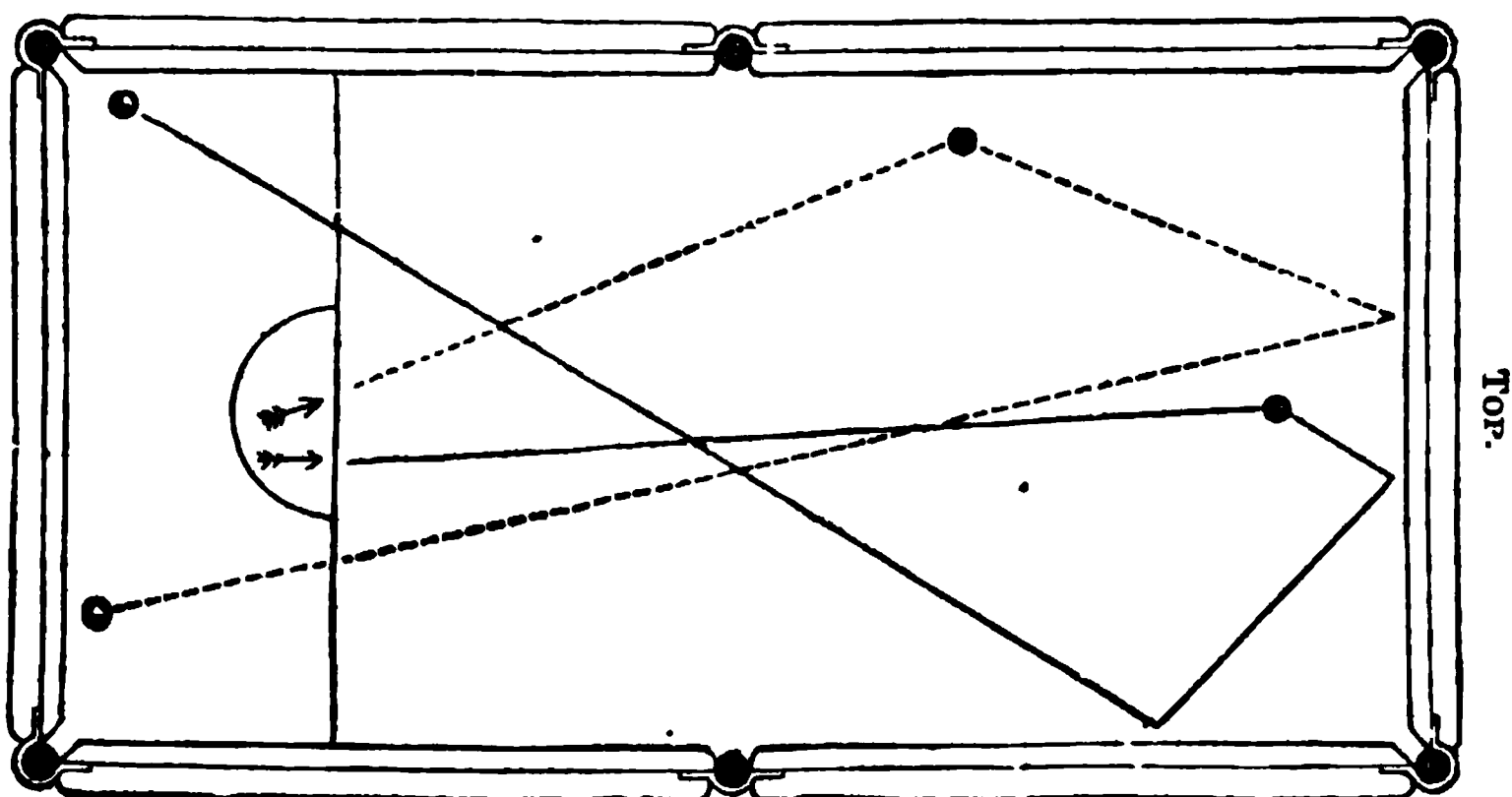


Fig. 14.

refer to another stroke. It will be found easiest to spot the ball rather to the right in the semicircle, and play the stroke with a little right-hand side. The stroke is an easy one, for the reason that the player has so many chances of succeeding, even if he makes a slight error in taking aim. If he hits the red ball rather too hard, or puts on too much side, he has still a good chance of scoring the

cannon by his ball striking the left-hand side cushion in baulk. On the other hand, should his ball strike the red too thin and with insufficient side, he will still very possibly get the stroke off the bottom cushion.

The position denoted by the dotted lines in Fig. 14 is one that frequently occurs, viz., a ball in baulk somewhere near the bottom cushions, and another ball out of baulk, but no losing-hazard left off it. The proper way to play for this cannon is to cannon on to a spot on the top cushion, half-way between the two spots on the top cushion, that would be formed by the intersection with the top cushion, of two lines drawn through the two object-balls parallel with the length of the table.

RULES OF BILLIARDS.

It only remains to provide the code of rules. The following are founded on those revised for Messrs. Cox and Yeman, the well-known billiard manufacturers, by the chief professional players. The most recent changes have been embodied, and some slight alterations have been made to render the rules more suitable for private players.

1.—The choice of balls and order of play shall, unless mutually agreed upon by the two players, be determined by stringing; and the striker whose ball stops nearest the lower cushion, after being forced from baulk up the table, may take which ball he likes and play, or direct his opponent to play first, as he may deem expedient.*

2.—The red ball shall at the opening of every game be placed on the top spot (12½ inches from the top cushion), and be replaced after being pocketed or forced off the table, or whenever the balls are broken.

3.—Whoever breaks the balls† must play out of baulk, though it is not necessary that he shall strike the red ball.

4.—The game shall be adjudged in favour of whoever first scores the number of points agreed on; or it shall be given against whoever, after having once commenced, shall neglect or refuse to continue when called upon by his opponent to play.

5.—A one-stroke is made by a miss either intentional or accidental, which is placed to the adversary's score.

6.—A two-stroke is made by pocketing an opponent's ball, or by pocketing the striker's ball off his opponent's, or by making a cannon; to effect a cannon the striker must cause his ball to strike both the others.

7.—A three-stroke is made by pocketing the red ball, by pocketing the striker's ball off the red, by running a coup, or by forcing the striker's ball off the table without hitting another ball, the last two strokes being placed to the adversary's score.

8.—A four stroke may be made by pocketing the white and spot-white balls, or by making a cannon and pocketing an opponent's ball, or by making a cannon and pocketing the striker's ball, the non-striker's ball having been first hit.

9.—A five-stroke may be made by scoring a cannon and pocketing the red ball, or by a cannon and pocketing the striker's ball, after having struck the red ball first.

10.—To effect a six-stroke the red ball must be struck first, and the striker's and the red ball pocketed; or six may be scored by cannoning off an opponent's ball on to the red and pocketing the two white balls.

11.—A seven-stroke is made by striking an opponent's ball first, pocketing it, making a cannon, and pocketing the red also, or by making a cannon and pocketing the red and an opponent's ball, or by playing at an opponent's ball first and pocketing all the balls without making a cannon.

12.—An eight-stroke is made by striking the red ball first, pocketing it, making a cannon, and pocketing the striker's ball; or by hitting the red first and pocketing all the balls without making a cannon.

13.—A nine-stroke is made by striking an opponent's ball first, making a cannon, and pocketing all the balls.

14.—A ten-stroke is made by striking the red ball first, making a cannon, and pocketing all the balls.

15.—If the striker scores he continues to play until he ceases to make any points, when his opponent follows on.

* It is imagined by some persons that the receiver of points, if any be given, is bound to lead off. But this is wrong; for the points given are understood to equalise the game. Why, therefore, should one party give away any supposed advantage he may possess over the other?

† Breaking the balls is placing them as at the commencement of the game.

16.—If, when moving the cue backwards and forwards, and prior to a stroke, it touches and moves the ball, the ball must be replaced to the satisfaction of the adversary, otherwise it is a foul stroke; but if the player strikes and grazes any part of the ball with the cue it must be considered a stroke, and the opponent follows on.

17.—If a ball rebounds from the table, and is prevented in any way, except by the cushion, from falling to the ground, or if it lodges on a cushion and remains there, it shall be considered off the table, unless it is the red, which must be spotted.

18.—Should a ball discontinue running and become stationary at the end of a pocket, and afterwards fall in, it must be replaced, and the adversary plays.

19.—Any ball or balls behind the baulk line, or resting exactly upon the line, are not playable if the striker be in hand; but he must play at a cushion or ball out of baulk before hitting another ball.

20.—Misses must be given with the point of the cue only. If the player strike his ball with the cue more than once, the non-striker may oblige him to play again, or may demand to have the ball placed at the point it reached, or would have reached, when struck first.

21.—Foul strokes do not score to the player, who must allow his opponent to follow on. They are made thus:—By striking a ball twice with the cue; by touching with the hand, ball, or cue, an opponent's or the red ball; by playing with a wrong ball; by lifting both feet from the floor when playing; by playing at the striker's own ball, and displacing it ever so little (except whilst taking aim, when it shall be replaced, and he shall play again).

22.—The penalty for a foul stroke is losing the lead, and, in case of a score, an opponent must have the red ball spotted, and himself break the balls, when the player who made the foul must follow suit, both playing from the D (or semicircle in baulk). If the foul is not claimed the striker continues to play.*

23.—After being pocketed or forced off the table, the red ball must be spotted on the top spot, but if that is occupied by another ball, the red must be placed on the pyramid spot. Should that also be occupied, it must be placed on the centre spot.

24.—If in taking aim the player moves his ball, and causes it to strike another, even without intending to make a stroke, a foul stroke may be claimed by an adversary.

25.—Forcing any ball off the table, either before or after a score, causes the striker to gain nothing by the stroke.

26.—In the event of either player using his opponent's ball and scoring, the red must be spotted and the balls broken again by the non-striker; but if no score be made, the next player may take his choice of balls, and continue to use the ball he so chooses to the end of the game. No penalty, however, attaches in either case, unless the mistake be discovered before the next stroke.

27.—No person, except an opponent, has a right to tell the player that he is using the wrong ball, or to inform the non-striker that his opponent has used the wrong ball; and if the opponent does not see the striker use the wrong ball, or, seeing him, does not claim the penalty, the striker scores any points he may have made.

28.—Should the striker, in playing up the table on a ball or balls in baulk, either by accident or design, strike one of them without first going out of baulk, his opponent may have the balls replaced, score a miss, and follow on; or may cause the striker to play again, or may claim a foul, and have the red spotted, and the balls broken again.†

29.—If the striker's ball touches another ball, any score he may make does not count, and the balls are broken; but a miss may be given to any part of the table, which does not count, and the adversary plays.

30.—If, when in hand, and in the act of playing, the striker moves his ball with insufficient strength to take it out of baulk, it shall be counted as a miss to the opponent, who, however, may oblige him to replace his ball and play again.

31.—If, in playing a pushing stroke, the striker pushes more than once, it is unfair, and any score he may make does not count. His opponent follows by breaking the balls.

32.—The "quill" stroke‡ from the baulk line is not allowable, and if a score be made, the opponent breaks the balls.

* Enforcing the penalty for a foul stroke is entirely at the option of the adversary.

† At first sight this would appear a harsh rule with a heavy penalty attached to it; but perhaps the adverse party may have laid his plans with skill, and he must not, therefore, have them frustrated with impunity. Besides, care must be taken that the adversary be not a sufferer by the blunders of the striker.

‡ The "quill" stroke used to be a very popular stroke made when the player's ball was in baulk, and when either the opponent's ball or the red ball was just overhanging the baulk-line, but sufficiently outside to make it playable, and in such a position as to render a losing hazard into either the bottom or middle pocket possible. The player's ball is then pushed, *not struck*, and the object ball barely grazed, so gently touched, in fact, that it is scarcely perceptibly moved from its position. By this stroke a succession of losing hazards from baulk is possible.

33.—If, in the act of drawing back his cue, the striker knocks the ball into a pocket, it counts three to the opponent, and is reckoned a stroke.

34.—If a foul stroke be made whilst giving a miss, the adversary may enforce the penalty or claim the miss, but he cannot do both.

35.—If either player take up a ball, unless by consent, the adversary may have it replaced, or may have the balls broken; but if any other person touches or takes up a ball, it must be replaced as nearly as possible.

36.—If, after striking, the player or his opponent should by any means obstruct or hasten the speed of any ball, it is at the opponent's or player's option to have them replaced, or to break the balls.

POOL.

OTHER games besides billiards may be played on a billiard table, and the most important of these is Pool. For this game special balls constitute the only difference in the implements required. There are several ways of playing pool; namely, with as many balls as there are players; with two balls only, the players taking turns, and playing with the alternate balls; playing at the nearest ball; playing at the last player; or the player playing at whichever ball he chooses. But the most popular mode is that in which the player plays at the last player. This is likewise the fairest way of playing the game.







In this last game winning hazards alone are of value, and the efforts of the players are concentrated in the endeavour to pocket the balls of opponents, and to leave their own in such positions on the board that it is almost impossible for succeeding players to pocket *them* in turn. The game is called Pool, from the fact that each player contributes to a common fund some specified amount, which it is understood will be taken by the winner of the game. A few counters from each person will probably answer the required purpose. In addition when a player's ball is pocketed he pays "a life"—(whatever may have been agreed upon)—to the person taking him. Each player has three lives, and when these have been lost by every player but one, the game is won by that player who still retains a life or lives. If two players are left in with an equal number of lives, they may either divide the pool or play the game out. When a player pockets a ball he is allowed another turn, and then plays on the ball nearest him. The rules of the game differ considerably, but as a code is always supplied with the other paraphernalia, it is hardly necessary to give them.

PYRAMIDS.

THIS game (also known as Pyramid Pool) is another which may be played on an ordinary billiard table, but fifteen red balls and one white ball are required. The fifteen red balls are arranged in a pyramid, with the apex towards the player, at the top of the table, the ball forming the apex being placed on a special spot referred to in the description of the billiard table, and known as the pyramid spot. The game is played by two persons who strike in turn with the white ball and endeavour to pocket the red balls, the game consisting entirely of winning hazards. The player who pockets the majority of the red balls wins the game. Should either player pocket the white ball he loses a point and has to replace a red ball on the table—on the pyramid spot, should it be vacant; otherwise on the billiard spot. Failing both of these spots the ball to be replaced must be put as near the pyramid spot as possible. Each player continues to strike until he fails to score. With slight modifications the game may be played by three or more players. In this case they play in turn, and each endeavours to pocket as many red balls as possible.

CHESS.

WITHOUT entering upon the history of Chess, or discussing its antiquity, it will be desirable to proceed at once with the practical consideration of the game. The board (Fig. 1) resembles an ordinary draught-board, and is so placed that each player has a white square at his right hand bottom corner. The sixteen pieces at each player's disposal (in Fig. 1 they are arranged as at the beginning of a game) include six different kinds:—

Eight pawns (abbreviated P) represented thus	
Two Knights (Kt), thus	
Two Bishops (B), thus	
Two Rooks, sometimes improperly called Castles (R), thus	
A Queen (Q), thus	
A King (K), thus	

The rooks occupy the corner squares; next to them on each side is placed a knight; then a bishop; the king and queen occupy the two centre squares of the first row; and the eight pawns are placed in front on the second row. The queen stands always on a square of her own colour. Thus the black queen stands on a black square, and the white queen on a white square. It may be as well to mention here that in all diagrams the white men are supposed to occupy the bottom of the board, and the black the top.

As to the directions in which the various pieces or "men" move, the rook moves in a straight horizontal, or perpendicular line to right or left, backwards or forwards. The rook, bishop, and queen may move, in their proper direction, one or more squares at a time, according to the player's judgment, and provided always that the road is clear, that is to say, that no other piece intervenes.

The move of capture in all cases, excepting only that of the pawn, consists in removing the obnoxious man, the capturing piece occupying the victim's square.

The bishop moves diagonally, to right or left, backwards and forwards. A bishop having been placed on one colour cannot remove to another. Each side has one bishop on a black square, and one on a white square, and on these colours they remain. The queen, which is by far the most powerful piece on the board, can move diagonally, horizontally, or perpendicularly, at will. The knight's movements

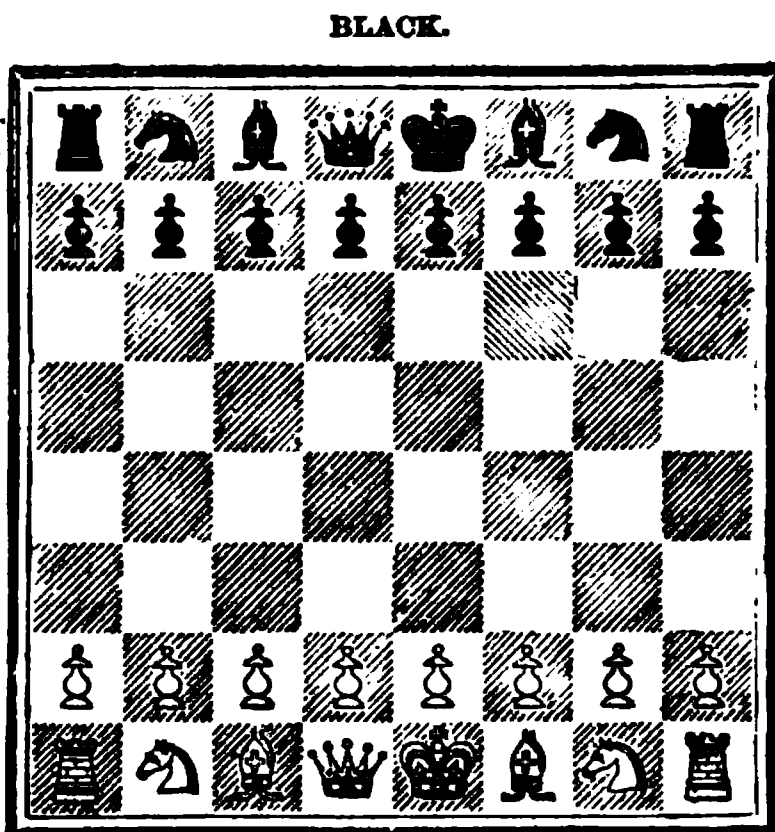


Fig 1. WHITE.

are much more difficult to describe. His range is confined to two squares, and he can advance neither more nor less. One of those squares is in a horizontal or perpendicular, the other in a diagonal direction: that is, he combines the shortest move of the rook with the shortest move of the bishop. He cannot

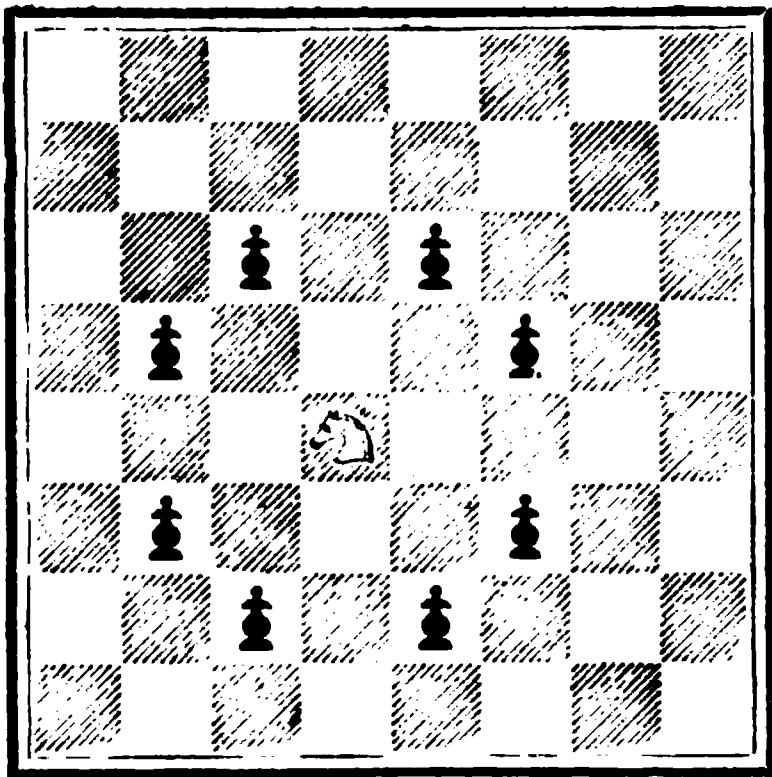


Fig. 2.

shorten or extend his eccentric flight, but, as a compensation, he is allowed to leap over the heads of either friends or foes in seeking a resting-place. In Fig. 2, the white knight, if he would move at all, must proceed to one of the eight squares occupied by the black pawns, any of which he can remove, himself filling the vacant square. He cannot interfere with the intervening squares, for (as we have seen) it is one of the conditions of his existence that his motion be limited to neither more nor less than two squares only, of which squares he must, when moved, occupy the second. The pawn cannot move backwards; he can advance only. At his first move he may be played one square or two at the option of the player; but afterwards he can advance only one square at a time. Accordingly if, escaping capture, he always goes forward, he must ultimately reach the eighth square, whereupon he is transformed, and enters on a new career of usefulness. The player who succeeds in advancing a pawn to the eighth square is entitled to exchange it for some superior piece, excepting the king. Positions occur in which the choice of rook, knight, or bishop would save or win a game, but, as a rule, the possessor of the pawn exchanges it for the queen; and hence the advance of a pawn to the eighth square is technically termed "*queening a pawn*." The pawn's mode of capturing is peculiar. Unlike all the other pieces, he cannot capture on his line of march, but diagonally from it. He marches like a rook, but takes like a bishop. Thus, whenever a pawn takes another pawn or a superior piece, the capturing pawn is transferred to another file, and you may accordingly find two, or even three, pawns upon one file. But the most peculiar method of capture possessed by the pawn is that known as "*taking en passant*." As this move is not easily appreciated, but is often of great importance, it must be explained in detail. On the left (Fig. 3) is a well-advanced black pawn, and a white pawn that has moved but one square. They meet diagonally, and, according to rule, the black pawn, if he had the move, could capture the white one, and occupy his square. On the right is a black pawn similarly advanced, and a white pawn that has never been moved.

He cannot shorten or extend his eccentric flight, but, as a compensation, he is allowed to leap over the heads of either friends or foes in seeking a resting-place. In Fig. 2, the white knight, if he would move at all, must proceed to one of the eight squares occupied by the black pawns, any of which he can remove, himself filling the vacant square. He cannot interfere with the intervening squares, for (as we have seen) it is one of the conditions of his existence that his motion be limited to neither more nor less than two squares only, of which squares he must, when moved, occupy the second. The pawn cannot move backwards; he can advance only. At his first move he may be played one square or two at the option of the player; but afterwards he can advance

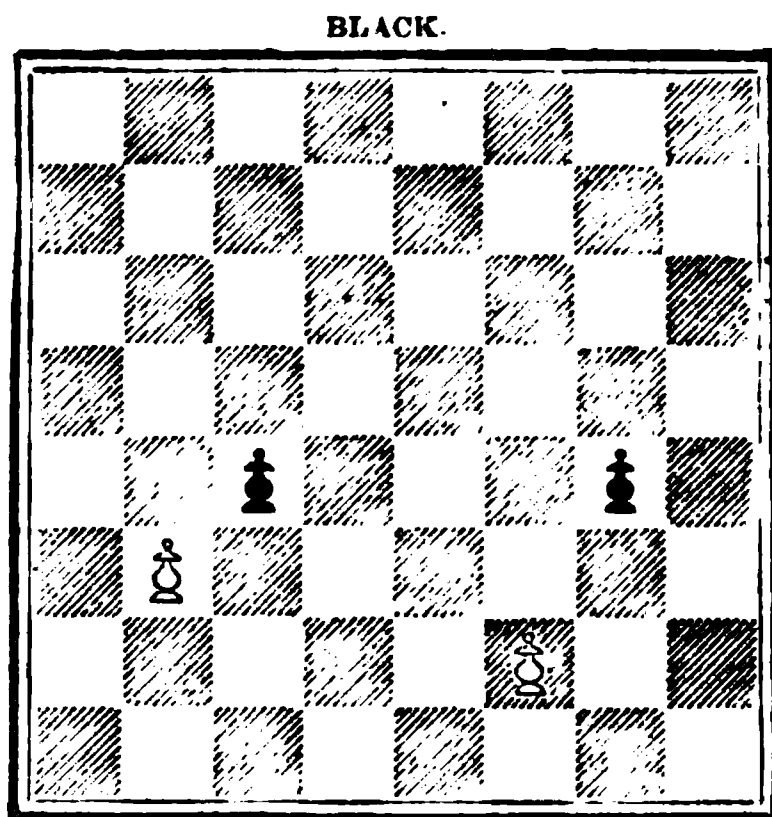


Fig. 3.

WHITE.

Suppose the player of the white men now advances this pawn two squares, as he can do on the first move, the player of the black men would have the opportunity of taking it off the board and of planting his pawn just as if the white had moved one square; that is, the capturing black pawn would not instal itself in the place the white pawn occupied after moving two squares, but in the place it (the white) *would* occupy if it had moved one square. This is the process of taking *en passant*.

The king is the last piece with which we have to deal; his movement is very simple. He can be played one square in any direction, backwards, forwards, sideways, or diagonally. Place him anywhere in the centre of the board, and he can command any of the eight squares around him. But the king has another part to play. He is the object for which every chess contest is waged. It is for the purpose of building up a successful assault, immediate or remote, upon the adverse king that each player conducts his operations. The player who first succeeds in driving his opponent's king into a certain position wins the game. He cannot be taken off the board. He may be attacked, but not captured. If an adverse piece brings him within the

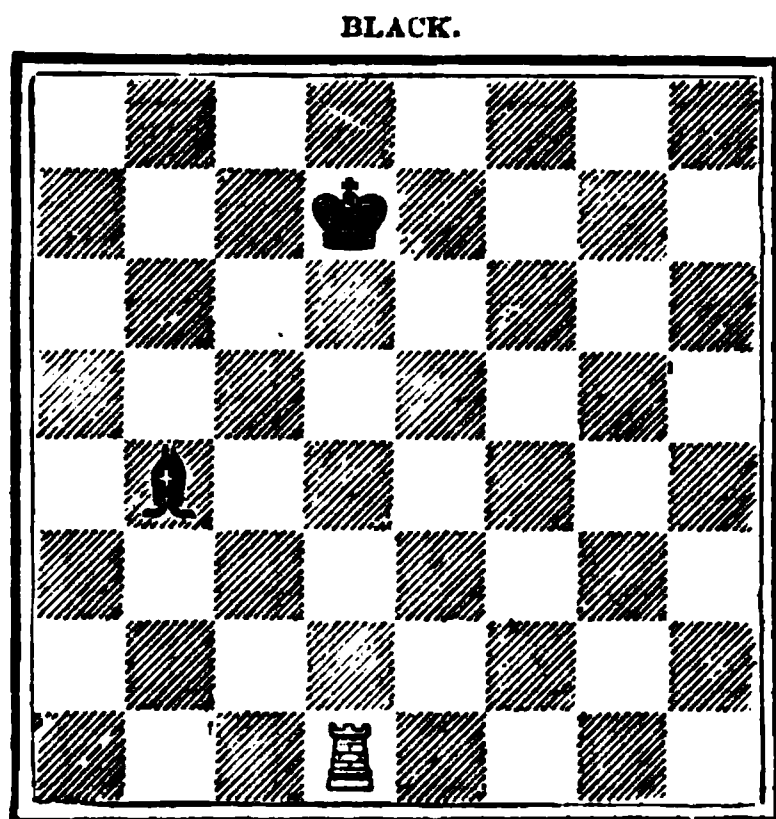


Fig. 4.

WHITE.

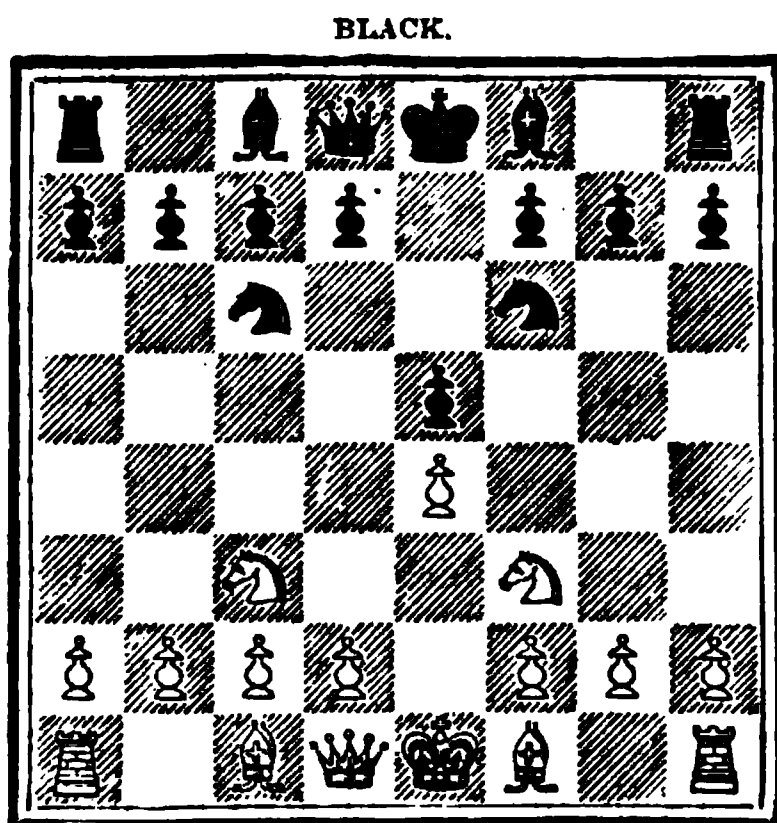


Fig. 5.

WHITE.

Unlike all the other pieces, the king cannot be taken off the board. He may be attacked, but not captured. If an adverse piece brings him within the line of its movement, it puts the king in "*check*." To give check to the king is to attack him. This brings us to the consideration of *check* and *checkmate*.

In the diagram (Fig. 4) the black king is within range of the white rook, which moves in a straight line parallel with the sides of the board. The rook could capture any other black piece, but being the king, the rook only gives "*check*." As, however, the king cannot be taken, so he cannot remain in check. He must forthwith free himself from the assault of an adverse piece. This he can do in three ways: by moving out of the range of the piece, by interposing one of his own pieces, so that the king may be covered from the attack, or, thirdly, by capturing the man giving check. In the position given above, the king may simply step on to either

of the adjoining files, and he is at once freed from check. Or the black bishop may be retreated to the black square immediately in front of the king, thus covering his majesty from the check of the rook. As the king must always be immediately relieved from check, it follows that he cannot move into check. He cannot be moved within the range of any hostile piece

Hence, also, as the range of the king extends but one square in any direction, the two kings cannot approach each other. At least a square must always separate them. Another observation respecting check is of importance. It is the peculiar feature of the knight that he can leap over the heads of his friends or foes; therefore, no piece can be interposed between him and the king.

There are but two ways of escaping from the check of the knight; he must be taken, or the king be moved.

So much for the obligation the king is under of escaping from check. But suppose he cannot fulfil this obligation; suppose that he can neither interpose a piece, nor capture the attacking man, nor remove to another square without exposing himself to the check of some other opponent. He cannot remain in check, and if he cannot get out, he is technically "*check-mated*," and the game is lost. Check-mate, therefore, is the fundamental principle of the game. The contest, strictly speaking, can be ended only by thus placing the chief piece in a situation from which he cannot escape. If either player sees that his position is hopeless, or that he is in great inferiority of force, he may terminate the game by simply resigning, and in the majority of cases this is the practical result. But carried to a complete issue, every game should end in checkmate.

Attention must now be turned to the system of *notation*, by which the moves are described. The notation is very simple, but absolute mastery of it is indispensable to the intelligent appreciation of all problems, games, and chess literature generally. Referring to Fig. 1, the square on which the king stands is called the king's square, that on which the queen stands the queen's square. The pieces on the king's side are named after the king, those on the queen's side after the queen,

BLACK.							
Q R 8	Q Kt 8	Q B 8	Q 8	K 8	K B 8	K Kt 8	K R 8
Q R 7	Q Kt 7	Q B 7	Q 7	K 7	K B 7	K Kt 7	K R 7
Q R 6	Q Kt 6	Q B 6	Q 6	K 6	K B 6	K Kt 6	K R 6
Q R 5	Q Kt 5	Q B 5	Q 5	K 5	K B 5	K Kt 5	K R 5
Q R 4	Q Kt 4	Q B 4	Q 4	K 4	K B 4	K Kt 4	K R 4
Q R 3	Q Kt 3	Q B 3	Q 3	K 3	K B 3	K Kt 3	K R 3
Q R 2	Q Kt 2	Q B 2	Q 2	K 2	K B 2	K Kt 2	K R 2
Q R sq.	Q Kt sq.	Q B sq.	Q sq.	K sq.	K B sq.	K Kt sq.	K R sq.

Fig. 6.

WHITE.

BLACK.							
sq. R	sq. Kt	sq. B	sq. Q	sq. K	sq. B	sq. Kt	sq. R
2 R	2 Kt	2 B	2 Q	2 K	2 B	2 Kt	2 R
3 R	3 Kt	3 B	3 Q	3 K	3 B	3 Kt	3 R
4 R	4 Kt	4 B	4 Q	4 K	4 B	4 Kt	4 R
5 R	5 Kt	5 B	5 Q	5 K	5 B	5 Kt	5 R
6 R	6 Kt	6 B	6 Q	6 K	6 B	6 Kt	6 R
7 R	7 Kt	7 B	7 Q	7 K	7 B	7 Kt	7 R
8 R	8 Kt	8 B	8 Q	8 K	8 B	8 Kt	8 R

Fig. 7.

WHITE.

thus:—king's bishop, king's knight, king's rook, queen's bishop, queen's knight, queen's rook. The square on which each piece stands is called its own square, that in front of it its second, third, fourth, &c., to the eighth. Thus each piece has a file of its own. King's first, which is simply called king's square, is followed by king's second, king's third, king's fourth, to king's eighth. Each player notates from his own side. If a white piece is played to any square, that square is calculated from the white side, if a black piece, from the black side. Thus the learner will readily

see that the white king's rook's sixth is the black king's rook's third, the white king's fifth the black king's fourth, and so on. Fig. 5 will afford an illustration of a few moves on each side. Here white began by advancing his king's pawn two squares, or to the fourth square of the king's file. This move would be called pawn to king's fourth. Black answered also with pawn to king's fourth. White then played his king's knight to king's bishop's third, and black answered with queen's knight to queen's bishop's third. White then moved out his queen's knight in like manner, and black brought out his king's knight. Abbreviated, these moves would stand thus:—

- | WHITE. | BLACK. |
|------------------|------------------|
| 1. P to K 4 | 1. P to K 4 |
| 2. K Kt to K B 3 | 2. Q Kt to Q B 3 |
| 3. Q Kt to Q B 3 | 3. K Kt to K B 3 |

The notation of all the squares, from the white and black sides respectively, may be readily learned from the accompanying diagrams (Figs. 6, 7). For the sake of clearness the distinction of colour is omitted. In Fig. 6 the moves of all the squares counting from the white side are given; in Fig. 7 those from the black.

It will be seen that the expressions for the various moves are abbreviated in the diagrams. This is always done in practice. We do not write king's square, but K sq.; not king's bishop's sixth, but K B 6; not queen's rook's seventh, but Q R 7.

"*Discovered check*" and "*double check*" will be more clearly understood from an example than from description. In the accompanying situation (Fig. 8), white, though so far inferior in force, can win easily with the move:—

- | WHITE. | BLACK. |
|--|----------------|
| 1. Q to K 6 (check) | 1. K to R sq. |
| If he go to K B sq. he is mated by the queen on K B 7. | |
| WHITE. | BLACK. |
| 2. Kt to K B 7 (check) | 2. K to Kt sq. |
| 3. Kt to K R 6 (discovered check and double check) | 3. K to R sq. |

Thus, a "*discovered check*" is obtained when a piece by removal opens upon the adverse king (that is, discovers or discloses) the attack of another piece, as the knight in this case does that of the queen. At the same time, the knight itself checks at K R 6, thus making not only "*discovered check*," but also "*double check*." It is obvious that there is but one way of escape from double check, and it is for the king to move. In the present position, the knight at K R 6 could be taken, but the capture of that piece would not release the king from the check of the white queen. Accordingly, black is constrained to play

- | WHITE. | BLACK. |
|---|---------------|
| 4. Q to K Kt 8 (check) | 3. K to R sq. |
| A beautiful move. | 4. R takes Q |
| He has obviously no other move—the king cannot take the queen on account of the knight. | |
| 5. Kt to K B 7 (mate) | |

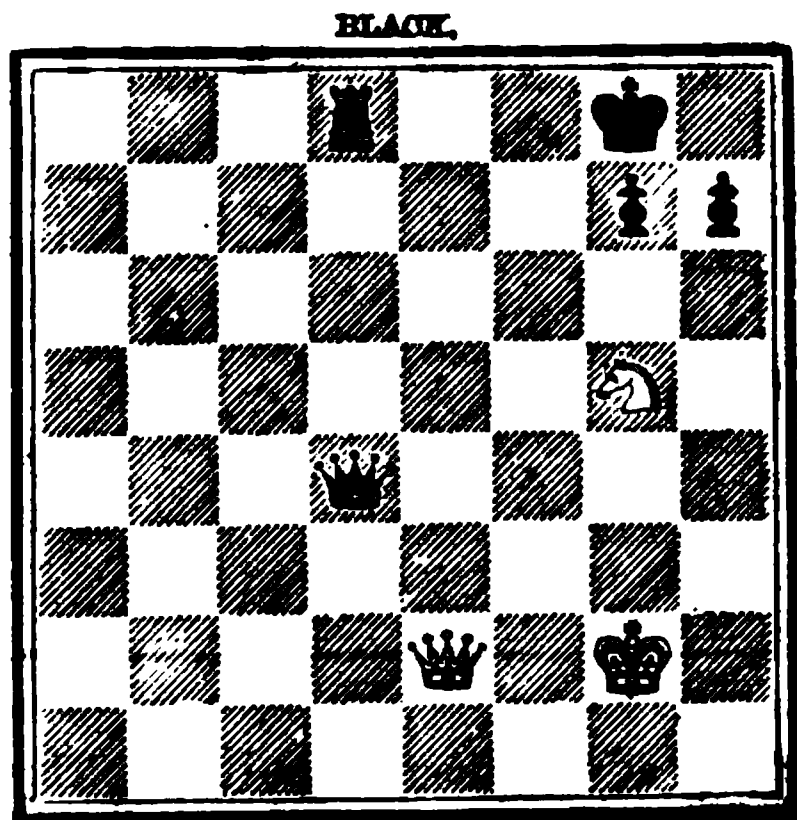


Fig. 8. WHITE.

This affords an instance of the "smothered mate," which occurs in those cases (like the present) in which the king, through being blocked up by pieces of his own colour, has not a vacant square to move into.

The one remaining operation yet to be explained is that of "castling." Once

BLACK.

in a game, the king of each player is allowed the peculiar privilege which is called by this name. As a rule, the king can move only one square at a time; but when he "castles" he not only moves two squares, but another piece—the rook—is allowed to move at the same time. The king and rook, in fact, are allowed at one move to cross each other, so that the king stands on the side of the rook, and the rook on the side of the king.

The conditions of castling are these:—1. The king must not have been moved; 2. The rook with which it is proposed to castle must not have been moved; 3. There must be no piece intervening between the king and the rook; 4. The king must not pass over a square commanded by a hostile piece; 5. The king must not be in

Fig. 9. WHITE.

check at the time of castling. These conditions must be rigidly observed. Castling is generally, and indeed ought to be, performed very early in the game, its advantage lying in the co-operation of the two rooks, which usually renders the "development" on both sides complete. Subject to the foregoing conditions, "castling" may be performed from either side. Thus, if White elect to castle with the king's rook, he moves (as in Fig. 9) king to K Kt sq., and rook to K B sq. If, on the other hand, he chooses to castle with the queen's rook (as in Fig. 10) he moves K to Q B sq., and R to Q sq. In each case the king moves two squares.

BLACK.

Respecting the relative value of the various pieces, it may be said that the pawn is the most humble and least valuable of all. A knight is supposed, in a general way, to be worth about three pawns and the fraction of a fourth. A bishop ranks a little higher, and is worth perhaps three and a half pawns. Thus, the knight and the

Fig. 10. WHITE.

bishop are practically well-nigh of equal value, and in actual play are exchanged for each other with little regard for the theoretical difference between them. But fine players have a great regard for the two bishops, if they can preserve them both on the board, for two bishops are indisputably superior to a knight and a bishop or two knights. In the case of a single knight

against a single bishop, the value is different. Indeed, in most positions the single knight is preferred, for he can leap to any square, whereas, a single bishop can run only upon the colour on which he was originally placed.

The rook is supposed to be worth about a knight and two pawns, or a bishop and two pawns. Perhaps he is a little more valuable towards the end of the game, when he is a most powerful piece, ranging in all directions and indifferently over both colours. But at the beginning of the game the case is different again. The rook is then difficult to bring into play. The pawns and pieces block his rectangular range, and it often happens that the game is decided before he can be of much use. In such a situation the sacrifice of a rook for a knight or bishop is often of great advantage, though in the vast majority of cases he is far superior to both. Nothing more than the vaguest general rule can be given for any of these values. The situation must almost always be taken into consideration in determining them. The queen is so far superior in ordinary positions to any of the minor pieces that she is very rarely indeed sacrificed for any single one of them. Speaking roughly, the queen is worth two rooks—a little more at the beginning of the game and a little less at the end.

There are no defined rules of play for Chess, but a few general maxims may be laid down. Develop all your forces before beginning operations. Bring out your knights, and bishops, castle early, and get the two rooks into co-operation. Young players are apt to neglect their rooks, and it is not uncommon for a beginner to be defeated before his rooks have been even moved. Yet how can you expect to win when two of your strongest pieces are left completely idle? When your pieces are all in battle array, bring all your available strength to bear upon the king, and endeavour to break through his entrenchments. As the object of Chess is to give checkmate, if you succeed in your assault upon the king, it matters not in what other quarter your adversary may make an impression. Fine players often carry on operations on the queen's side, or in the centre, knowing that no effective assault can be directed against the king; but this is merely an exception to the general rule. The queen, being the most important piece, should not be brought into action too early. She is liable to be attacked by the enemy's inferior pieces, and driven back with loss of time, and, perhaps, of position. Alone, too, the queen can make no impression upon the serried ranks of the enemy. The queen should, for the most part, follow the other pieces into the field, and supplement their movements. It follows, therefore, that she should in most cases be directed against the king. Also, she must not be removed too far from the centre of action. A good player will often, by the bait of a pawn or so, tempt his opponent to withdraw his queen from the main scene of operations, thus losing time and allowing the good player to accumulate an overwhelming force upon that main point. As the king is the object of attack, it is evident that great care must be taken of him during the heat of the combat, when there are so many hostile pieces on the board ready to assail him; but when the field is clear, and few pieces remain, the king becomes an important fighting piece, and should be freely made use of, especially in conjunction with the pawns.

The student of Chess must on no account neglect his pawns. In consequence of their comparative weakness and simplicity of movement, he is apt to hold them cheap. As a matter of fact the conduct of the pawns is amongst the abstrusest problems in Chess, and between fine players these seemingly insignificant men are often decisive of a closely-contested game.

The primary rule to be observed by the young player, in the guidance of his pawns, is this:—Take care of them. Your adversary should never be allowed to snatch one unawares. Fine players often give up a pawn, even at the beginning of the game, but never unless they expect some counterbalancing advantage.

If you can establish your pawns in the centre of the board, say at king's

fourth and queen's fourth, they will exercise a very restrictive effect on your opponent's game. Be careful, however, not to so establish them until you are ready with plenty of support, for your opponent may often get up an embarrassing attack upon two pawns so placed. Do not push your pawns too far in the early part of the game; they become weak, and are liable to be broken up and captured. Moreover, the enemy's pieces may often get behind your advanced array, and assail your king at a disadvantage.

A "passed" pawn is often of very great service. A pawn is said to be "passed" when its march is not opposed by any adverse pawn, either on the right or left hand or in front.

Avoid doubled pawns whenever possible; that is, do not, if you can help it, suffer one of your pawns to be brought up the same file as another, through the capture of a man. Nevertheless, doubled pawns are not always disadvantageous, if they be united with others. Be careful of advancing your pawns on the side on which you have castled.

The good habits and moral qualities which the chess-player should endeavour to cultivate are not less important to him than the scientific principles upon which the conduct of the game is based. A slovenly, hesitating, or noisy demeanour over the chess-board is prejudicial to the attainment of a fine style. The good player is known by his conduct as well as by his strategy. He does not hover with his hand over the board, first thinking of moving one man and then another; he does not finger the squares to see the effect of certain moves; he does not spend long in deliberating when there is but one move that, consistently with the laws of the game, he can possibly make; and, though good practitioners often lose their temper, it is a great advantage to a chess-player to be able to keep it.

First amongst the good habits to be cultivated by the beginner is that of scrupulously guiding his play according to the rules of the game. It follows, as a corollary, that he should insist upon his adversary doing the same. Unless this condition be observed it is idle to attempt to become a chess-player.

Hard as it may be at first to abide by a stipulation of the rules, which in a certain case may entail the immediate loss of a well-contested game, it is better to sacrifice a little for the sake of gaining much. In the end this strict attention to rule will become a confirmed habit, and great will be the gain thereby. Your style will more rapidly improve; the game will prove a pleasanter recreation; all squabbles will be avoided. One rule in particular is the stumbling-block to almost all beginners. It is that which stipulates that, if you touch a piece you must move it, and that on the square on which it is placed it must remain. So long as you have not quitted your hold of the piece you may play it to any square within its range; but, having touched it, you must make some move with it; and having removed your hand you cannot select another square. This ordinance causes more trouble to the tyro than all the rest. In "drawing-room chess" no heed whatever is commonly paid to it. The pieces are fingered, moved, and removed, without stint. Yet, not the less must the learner overcome the difficulty. He can never play well unless he does; indeed, all good players will insist upon the observance of the rule. If the touch and move principle be mastered, there will be the less difficulty in averting such slovenly habits as hovering and hesitating with the hand over the board, fingering the squares, and the like.

You must necessarily be a poor player at first; therefore, do not refuse to accept odds from a superior antagonist. You cannot expect him to feel any interest in a combat which, on even terms, must end in your easy defeat, nor will you improve so rapidly. He will not put forward his full strength if he can beat you without trouble. Some players think it "disgraceful" to take odds: this is foolish.

As to the time that should be spent over an ordinary game, Chess will be found pleasant, and the practice improving, if an average of about an hour is devoted to one game. Such an average will alike obviate unbearable tedium and destructive carelessness. The beginner should conduct his game steadily, not hastily moving in an apparently simple position, nor spending too much time over a complication. He should look to his opponent's game as well as his own, and consider not merely what he himself can do, but what his adversary can do also. Chess is not usually, and ought never to be, played for money.

It is, perhaps, idle to recommend you to keep your temper when losing; that depends upon the kind of temper you may happen to possess. But, at any rate, do not be discouraged. Play the game you have lost over in private; note where your opponent played well, and where you played badly. Chess is a game of great mental activity. Trouble and perseverance are necessary to play it well. Nor is it a disadvantage that so much pains should be required, for, in these civilised times, no game is worthy the name of pastime which depends too largely upon chance, or which may be learned in a day.

The following Laws of Chess are condensed from the code given by Mr. Staunton:—

THE LAWS OF CHESS.

1. *Position of the Board.*—If during the progress of a game either party discover that the chess board has been improperly placed, he may insist upon its being adjusted; the game to proceed from the point where the adjustment took place, as if no mistake had been made.

2. *Omission or Misplacement of Men.*—If at any time in the course of a game it be found that the men were improperly placed, or that one or more of them were omitted, the game must be annulled. (N.B.—An annulled game is to be considered in all respects as if it had never been played.)

3. *First Move and Choice of Colour.*—The right to the first move in the first game of a sitting is determined by lot. The choice of colour must be determined in the same way, if either party require it. Unless another arrangement be made, each player has the first move alternately throughout any one sitting or match, whether the games be won or drawn. But in the case of an annulled game, the player who had the first move in that game shall also have the first move in the next.

4. *Commencing out of Turn.*—If a player make the first move when it is not his turn to do so, the game must be annulled if the discovery be made before the completion of the fourth move. If the error be not discovered until afterwards, the game must proceed in due course. In a match an extra first move must be allotted to the player thus deprived of his move.

5. *Playing Two Moves.*—If a player in the course of a game make a move when it is not his turn to play, he must retract the last move, and, if his adversary chooses, after he himself has moved, must play the man wrongly moved, if it can be played legally. But the adversary can enforce this penalty only before touching a man in reply. If the error be discovered later, it must be rectified simply by the *giuoco a monte*, i.e., the moves must be retraced to the point where the error took place.

6. *Touch and Move.*—A player who touches with his hand one of his own men, when it is his turn to play, must move it if it can be legally moved, unless before touching it he say *j'adoube* (I adjust), or words to that effect. And a player who touches one of his adversary's men (under the same conditions), must take it. If in either case the move cannot legally be made, the offender must move his king, and in the event of the king having no legal move, he must play any other man legally movable that his adversary pleases. If a player, however, touches a man in consequence of a false cry of "check," or being checked and not apprised of it by his adversary, touches a man, he is not obliged to play it, or, having played it, may retract the move without penalty.

7. *Definition of a Move.*—A move is complete and irrevocable the moment the piece or pawn has quitted the player's hand; but as long as the hand remains on the man touched, it may be played to any square it commands. This stipulation does not, of course, apply to illegal moves.

8. *False Moves.*—If a player move a piece or pawn of his own to a square to which it cannot be legally moved, or capture an adverse man by a move which cannot legally be made, he must, at the choice of his adversary, either—

Firstly—Move his own or take the adverse man legally ;

Secondly—Forfeit his turn to move ; or

Thirdly—Play any other man legally movable which his adversary may select. Castling wrongfully is to be considered a false move.

9. *Touching more than one Man.*—If a player, when it is his turn to move, touch with his hand more than one of his own men (unless in castling), he must play any one of them legally movable that his opponent selects. If he touch more than one of his adversary's men, he must capture whichever of them his adversary chooses, provided it can be legally taken. If in such case it happens that none of the men so touched can be moved or captured, then the offender must move his king, or if the king cannot legally be moved, he must play any other piece or pawn legally movable that his opponent may name.

10. *Enforcing Penalties.*—A penalty can only be enforced before the party who has not committed the error has touched a man in reply. If the illegality be discovered at a later period the moves must be retracted, the error rectified, and the game renewed from that point. But if the source of an illegality cannot be discovered, the game must be annulled. When the king is moved as a penalty, the party paying the penalty cannot castle on that move.

11. *Check.*—A player must audibly say "check," when he makes a move which puts the hostile king in check. A player is not compelled to give check because he utters it. But if it is uttered and not given, the move on which it is uttered must be retracted and another made, if the adversary require it. If a player move his king into check ; if he remove a piece which covered his king, and thereby place him in check ; if, while his king is in check, he touch or move a man which does not cover the check—in each of these cases he subjects himself to the penalties laid down in Section 6.

12. *A King remaining in Check.*—If the king of either player is placed in check, and the check has not been announced or discovered until one or more moves have been made, all moves subsequently made must be retracted, and the player who ought to have announced the check must make some other move. If the check has been duly announced, but still not provided against, the moves must only be retracted as far as that of the king, which must be placed out of check in any manner its player chooses. If the moves cannot be remembered, the game must be annulled.

13. *J'adoube.*—When a player touches a man for the purpose of adjusting it, and not with the intention of moving it, he must, before touching it, say *j'adoube*, or words to that effect. But it is of no avail to say *j'adoube* after the man has been touched. In that case the piece or pawn must be moved.

14. *Counting Fifty Moves.*—If at any period of a game one player should persist in repeating a particular check or series of checks, or the same line of play, his adversary can demand that the game shall be limited to fifty more moves on each side ; and if within that limit neither party win, the game must terminate as a drawn one.

Secondly, when a player has only the king on the board, he may insist upon his adversary winning in fifty moves, or upon the game being drawn.

Thirdly, when one player has only a king and queen, king and rook, king and bishop, or king and knight, against an equal or superior force, he may insist equally upon the fifty move limit.

Fourthly, whenever one player considers that the game ought to be drawn, or that one side can force a win, the umpire or bystanders shall decide whether the fifty move limit ought to be applied ; it being understood that the limit is not applicable in cases where several pieces remain on the board at the same time.

None of the foregoing clauses apply to games wherein one party undertakes to mate with a particular man or on a particular square.

15. *Upsetting the Board or Men.*—If the board or any of the men be upset or displaced, the pieces must be re-arranged as they were when the accident took place, and the game proceed in due course. The opinion of the player who did not upset the board shall always prevail over that of the player who did. Wilfully upsetting the board is equivalent to resigning the game.

16. *Dropped Man.*—If at any time it is discovered that a man has been dropped off the board, and moves have been made during its absence, such moves shall be retracted and the man restored. If the players cannot agree as to its restoration, the game must be annulled.

17. *Umpire.*—The umpire shall have authority to decide any question whatever that may arise in the course of a game, but must never interfere, except when appealed to by one of the players, unless a violation of the fundamental principles of the game has taken place. When a question is submitted to the umpire or to bystanders, their decision shall be final.

Place your board and men in proper array for action, and let us play a game together. We will not indulge in any of the refinements of chess strategy, but work through a plain game, illustrative of the leading principles of chess, and the chief errors to be avoided. Imagine that you are playing the white men, and that Black is conducted by some imaginary adversary.

WHITE.
1. P to K 4

BLACK
1. P to K 4

It is most usual for each player to commence with this move. The game may be opened in many other ways, with more or less advantage, as we shall afterwards see; but nine persons out of ten begin thus. The advance of the king's pawn releases both the queen and the king's bishop, and allows the forces to be rapidly developed.

2. K Kt to B 3

2. Q Kt to B 3

By bringing out your king's knight you attack his K P, which he prudently defends with his queen's knight.

3. B to Q B 4

3. B to Q B 4

This is the most commanding position for the king's bishop, since it attacks the adversary's K B P, which, being defended only by the king, is the weakest point of his line. The opening we have selected is one of the oldest known to chess players. It involves no sacrifices or risks, leads to a rapid development of the pieces, and generally produces solid and interesting games.

4. P to Q 3

4. K Kt to B 3

You have a wide range of good moves at this stage. You may castle, or bring out your Q Kt, or advance P to Q B 3 with the view of afterwards playing P to Q 4, and establishing your pawns in the centre. Black plays properly in getting out his K Kt as soon as possible.

5. Castles

5. P to Q 3

Young players are apt on this or the preceding move to advance their K Kt to Kt 5. This is a waste of time and a premature attack. Black castles, and if you then take his K B P with your Kt you give up two pieces for a rook and a pawn—a bad bargain, since two pieces are worth rather more than a rook and two pawns.

6. P to K R 3

6. P to K R 3

Both combatants play thus to prevent the adverse Q B coming to K Kt 5, and pinning the knight. Occasionally this precaution is necessary; in the present position it is much a matter of taste.

7. Q Kt to B 3
8. Q Kt to K 2

7. Castles
8. Q B to K 3

It is generally good play to bring the Q Kt round by K 2 to K Kt 3, whence it may often be posted at K B 5 with destructive effect. Black determines to get rid of your K B for his Q B, but this proceeding, as we shall see, was not an advisable one.

9. Q Kt to K Kt 3
10. Q P takes B

9. B takes B
10. Kt to Q 5

It used to be the practice for the first player to retreat his K B to Q Kt 3 when faced by the adverse Q B. But this manœuvre lost a move; moreover, it was found better to leave the K B at Q B 4. If Black take it with his Q B, as he does in this instance, you open a file for your queen and rooks, which more than recompenses you for your double pawn. At his tenth move Black offers

you the exchange of knights, but you decline, and retreat the K Kt to R 2. Here he appears a little out of play, but he occupies a good position shortly.

WHITE.
11. Kt to R 2

BLACK.
11 P to Q B 3

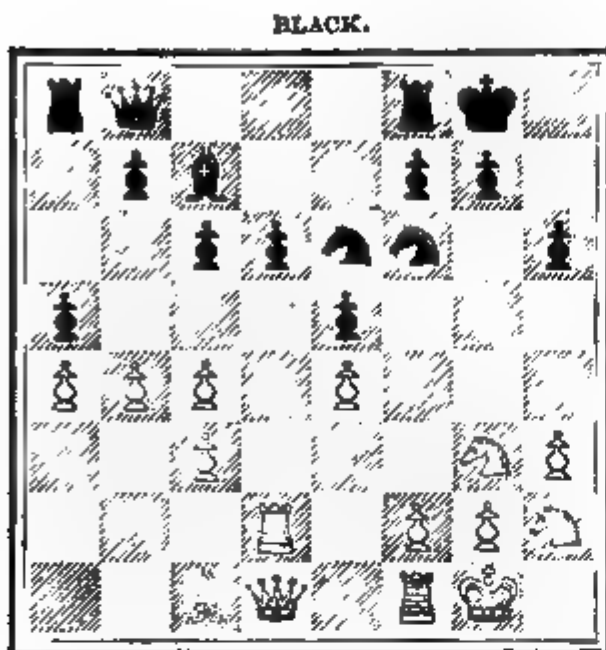


Fig. 11. WHITE.

with pawn, for he would lose his queen for a rook. Should he advance P to Q 4 his centre pawns become weak and are liable to fall. He therefore determines to provide against this embarrassment beforehand. You may note that it would be useless for him to exchange his Q R P for your Q Kt P, since all your pawns are well defended.

12. R to Q 2 13. Q to Q Kt sq.

You pursue the object mentioned in the preceding remarks. You now threaten P to Q B 5, to avoid which Black must take his queen away from the file commanded by your rook. For if he retreated his knight to K sq. to defend his beleaguered Q P, you would play Kt to K B 5 and Q to K Kt 4 having a terrible attack. Nor can Black move his queen to K 2, for you would immediately attack her with your knight. He therefore carries her to Q Kt sq. But by so doing he removes her majesty so far from the centre of action that he would have almost done better had he abandoned the Q P to its fate. Black indeed has a bad game, and your position is far superior.

Position of the forces at this critical juncture (Fig. 11).

17. K R to K sq.
18. P takes P

17. P takes Kt P
18. Kt to Q 5

Black perceives that your pawns will attack his Kt and B, and he desires a safe outlet for the latter.

12. P to Q B 3 13. Kt to K 3.
13. P to Q Kt 4 13. B to Q Kt 3

Evidently, Black lost time by playing his Kt to Q 5 at move 10. His pieces have been driven back, and your pawns have become threatening.

14. P to Q R 4 14. P to Q R 4

Black replies thus in order to prevent the continued advance of your pawns.

15. R to Q R 2 15. B to Q B 2

The object of this move with your rook must be carefully appreciated. You threaten R to Q 2, attacking his Q P, and when he defends it with Kt or B you may push P to Q B 5. Obviously in such a situation he could not take pawn

BLACK

Fig. 12. WHITE.

You defend your K P with rook in order that you may play Kt to K B 5. Black exchanges pawns, thinking that he may afterwards capture your weak Q R P. By his 18th move Black thinks not only to block up your attack upon his Q P, but also to prevent your knight going to K B 5.

WHITE.
19. Kt to K Kt 4
20. Q takes Kt

BLACK.
19. Kt takes Kt
20. R takes Q R P

This capture by Black affords an example of the importance of avoiding all loss of time at chess. A pawn is valuable, but Black's king is in a critical condition, and he takes no steps to defend him. By thus greedily snatching at the pawn, White is allowed time to render his attack irresistible.

21. R takes Kt 21. P takes R

The object of this sacrifice was to free your Q B without loss of time. The power of the Q B in this attack will be seen immediately.

22. Kt to K R 5 22. P to K Kt 3

He has evidently no other move to avoid mate; but if you had not taken off his knight, he could have saved himself by retreating it to K 3.

23. B takes K R P 23. R to Q sq.

He evidently cannot take your knight on account of the position of your queen. But by attempting to save his rook he throws away his last chance. He should have moved B to Q sq. to avoid the check at K B 6.

24. Kt to K B 6 ch. 24. K to R sq.
25. Q to K R 4

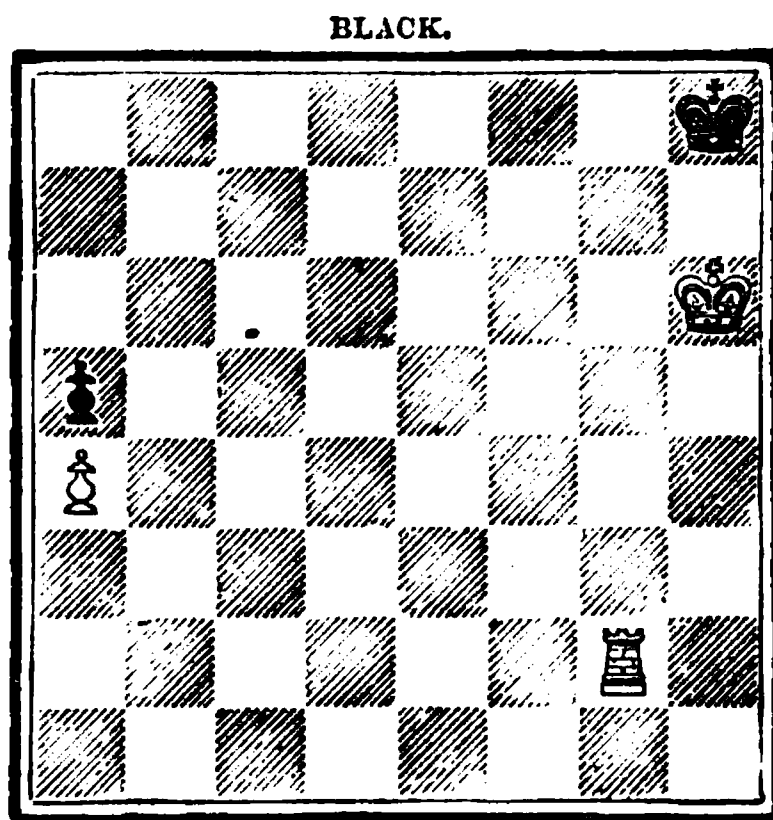


Fig. 13.

WHITE.

And you will see that Black has no means of avoiding the discovery of mate by the bishop.

Position at the close:—Fig. 12.

A few words may here be fitly said about the simpler forms of end-games. Speaking generally, the young player in ending the game should beware of useless checks. His object is to drive the adverse king to the end or corner of the board, where he can be finally checked without possibility of escape. Secondly, if the force at your command consist of only one or two pieces, you must be careful to follow up the adverse king with your own, the assistance of the monarch being, in such cases, indispensable to mate. If you carry on operations with your piece or pieces alone, you will find it impossible to confine the hostile king. He will return to the place whence he came, and your labour will be lost. Thirdly, beware of stale-mate. You give stale-mate, which is a drawn game, if you place the adverse king in such a position that he cannot move, but is not at the time in check, and has no other piece which he can move. Thus, though you may have a winning advantage, you bring upon yourself a drawn game. Fig. 13 is a simple example of stale-mate. Here, it will be seen, the black king is not in check, and yet cannot move without going into check. He cannot approach the white king, and the K Kt sq. is commanded by the rook. The black pawn cannot move. The game is, therefore, drawn.

You can win, i.e., force check-mate with king and queen, king and rook, king

here. It may, however, be mentioned that to effect this mate, the king must be driven not only to a corner square, but to one which is commanded by the bishop.

King and pawn against king is commonly a won game for the former, that is, the player having the pawn can generally force it to the eighth square and make a queen. This result, however, depends entirely upon the power of performing a manœuvre which is technically known as "gaining the opposition." By this is meant the playing of the king in such a manner as to force the hostile king to abandon certain important squares. In chess it is generally advantageous to gain a move; but in end-games a move gained often involves the loss of the game.

An example will better illustrate the nature of "the opposition."

In Fig. 15, White, having the move, gains the opposition, and wins easily:—

WHITE.
1. K to Q 6.
2. K to Q B
3. P to Q 5

BLACK.
1. K to K sq.
2. K to K 2

And White obviously forces the pawn to the eighth square. If, instead of 1. K to K sq., he had moved 1. K to Q B sq., the reply is K to K 7, the position being precisely similar. Here the white king is able to drive his black rival from the important squares, and so win the day. But if Black had the first move he would be able to draw:—

2. K to K 5 1. K to Q 2
 2. K to K 2

If White go to Q B 5, Black moves to the other side, opposite the white king.

3. P to Q 5 3. K to Q 2
4. P to Q 6 4. K to Q sq.
5. K to K 6 5. K to K sq.
6. P to Q 7 ch. 6. K to Q sq.

And White must either abandon the pawn or give stale-mate if he support it. Had Black, at his fourth move, played K to K sq., instead of to Q sq., White would have won:—

5. K to K 6
6. P to Q 7
7. K to K 7, and queens the pawn.

4. K to K sq.
5. K to Q sq.
6. K to Q B 2

From this analysis is deduced the important general rule that if the player with the pawn advances it to the seventh square *not* giving check, he wins; if he checks, he draws only.

When the pawn is on the rook's file, it can never reach the eighth square if the black king can get in front in time.

King and two pawns, unless doubled on the rook's file, always win against the king alone. King and two pawns generally win against king and one; but in this case the result depends largely upon position, of which the variations are infinite.

The queen wins against any single piece, the knight, bishop, or rook being soon forced to take up a position where it can be won by a check of the queen. The queen also mostly wins against a single piece and a pawn, the exceptions being when the pawn is very far advanced and cannot be stopped.

The queen in most cases wins against two knights, knight and bishop, or two

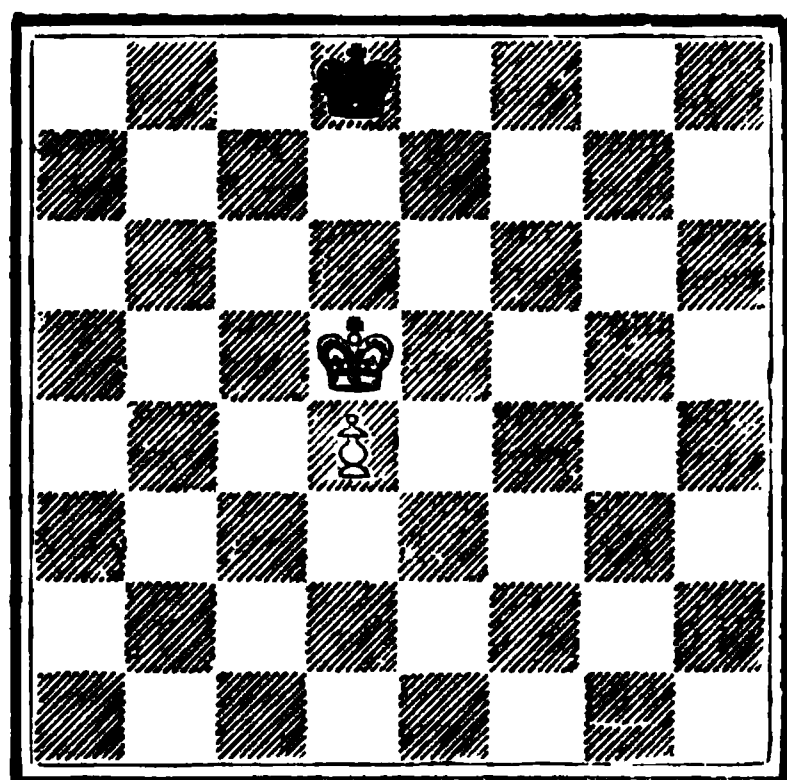


Fig. 15.

WHITE.

bishops: but can only draw against rook and minor piece, two rooks, or three minor pieces. Indeed, aided by a pawn, these forces will often win.

A bishop or knight generally draws against a rook, though occasionally positions occur where the more powerful piece can win the weaker one.

A rook and knight or rook and bishop draw in most cases against the rook.

Three minor pieces win against the rook, except in cases where two of the three are knights, and the rook can be exchanged for the bishop. In such positions the result is a draw, for two knights cannot give check-mate.

A single pawn will often draw against a rook if the adverse king cannot come up in time, since the rook must be exchanged for the pawn in order to prevent it queening. But if the king can come to the assistance of the rook, the pawn easily falls. So do two pawns; but if the king cannot get up, two united pawns will win, since the rook can be exchanged for only one of them. Three united pawns often win against the rook, even if the hostile king can get in front of them. In all these cases it is presumed that the pawns are supported by their king.

Queen against queen and pawn generally results in a drawn game, for the single queen may give perpetual check.

Rook and pawn against rook win or draw according to the position of the kings. For instance, supposing White to have the pawn, Black can draw if he succeed in getting his king in front of the pawn on the file on which the latter is advancing. On the other hand, should Black fail in placing his king in front of the pawn, White will win the game.

Before concluding this article on Chess we have to consider the openings. As to the "regular" openings, as they are called, after 1. P to K 4 on each side, the first player may proceed with several moves. That which is most favoured is 2. K Kt to B 3, forming what is styled the king's knight's opening. Black, in reply, has a choice of moves, of which the three best are 2. K Kt to B 3; or P to Q 3; or Q Kt to B 3. The first is called "Petroff's defence," or the Russian game.

WHITE.
1. P to K 4
2. Kt to K B 3
3. Kt takes K P
4. Kt to K B 3
5. P to Q 4
6. B to Q 3
7. Castles

BLACK.
1. P to K 4
2. Kt to K B 3
3. P to Q 3
4. Kt takes K P
5. P to Q 4
6. B to K 2
7. Castles

And each party proceeds to develop his game on the queen's side, the situation being about even.

The second defence, P to Q 3, is called Philidor's.

1. P. to K 4
2. Kt to K B 3
3. P to Q 4
4. Q takes P
5. B to Q Kt 5
6. B takes Kt
7. Kt to Q B 3

1. P to K 4
2. P to Q 3
3. P takes P (best)
4. Kt to Q B 3
5. B to Q 2
6. B takes B
7. Kt to K B 3

White has a little the freer position.

The third and regular defence, 2. Q Kt to B 3, is most frequently adopted.

1. P to K 4
2. Kt to K B 3
3. B to Q B 4

1. P to K 4
2. Kt to Q B 3
3. B to Q B 4

Forming what is termed the *giuoco piano*, a sound and safe *début*, frequently adopted. Each side gets out his pieces, and the game is even.

Instead of 3. B to Q B 4, White may move 3. B to Q Kt 5, and form the Ruy Lopez game.

WHITE.	BLACK.
3. B to Q Kt 5	3. P to Q R 3
4. B to Q R 4	4. Kt to K B 3
5. P to Q 3	5. P to Q 3
6. P to K R 3	6. P to Q Kt 4
7. B to Q Kt 3	7. B to K 2

The game is even.

Or White may continue 3. P to Q 4, forming the Scottish "gambit." A "gambit" is an opening wherein the first player gives up a pawn to obtain a better position. The gambits lead to positions of great interest, but are hazardous, for if the pawn be retained by Black, a lost game for White is almost a certainty. In the Scottish gambit, however, the pawn may be regained immediately.

3. P to Q 4	3. P takes P
4. Kt takes P	4. B to Q B 4
5. B to K 3	5. Q to K B 3
6. P to Q B 3, &c.	

White may also move 3. P to Q B 3, forming the queen's bishop's pawn's game:—

3. P to Q B 3	3. P to Q 4
4. B to Q Kt 5	4. P takes P
5. Kt takes K P	5. Q to Q 4

The learner will remember how the *giuoco piano* game is brought out. If White at his fourth move play 4. P to Q Kt 4, he forms the Evan's gambit. This is one of the most celebrated of openings. If the pawn be taken

4. P to Q Kt 4	4. B takes P
5. P to Q B 3	5. B to Q R 4 or Q B

White then castles, and moves P to Q 4, establishing his pawns in the centre. His queen and queen's bishop can rapidly be brought to the assault of the adverse king, and the attack is so great that it often compensates for the pawn. But with the best play, the Evan's gambit breaks down, and the defence wins.

So much for the king's knight's opening. If White, at his second move, play 2. B to Q B 4, instead of bringing out his K Kt, he forms the king's bishop's opening. Black's best reply is to bring out his K B also, or his K Kt.

Amongst the most important varieties of the "regular openings" is the king's gambit. This is formed by placing P to K B 4 at the second move. This pawn the second player may take or refuse. If he take it, and White plays 3. K Kt to B 3, the opening becomes the king's knight's gambit; if White brings out his K B to Q B 4, the king's bishop's gambit is formed. But the second player may decline the gambit, in which case the opening may proceed thus:—

1. P to K 4	1. P to K 4
2. P to K B 4	2. B to Q B 4

The best mode of declining the gambit.

3. Kt to K B 3	3. P to Q 3
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If White take the K P at his third move, Black gives a fatal check at K R 5 with his queen.

4. B to Q B 4	4. Kt to K B 3
5. Kt to Q B 3	5. Kt to Q B 3
6. P to Q 3	

And White obtains a little the freer position.

The king's gambit requires exceedingly delicate and skilful play, and the beginner should not attempt it until he has acquired some experience.

The "irregular" openings are those in which one or both players do not commence by 1. P to K 4. They gave rise to solid and substantial games, and differ from the regular openings in this respect, that whilst in the latter the two combatants have a limited choice of sound moves, in the irregular games there is generally an infinite variety of good lines of play at command.

First, with regard to the cases where White plays 1. P to K 4, but Black does not. The second player may answer 1. P to K 4 with 1. P to K 3 (the French game), 1. P to Q B 4 (the Sicilian game), or 1. P to Q Kt 3 (the Fianchetto), or 1. P to Q 4 (the centre counter gambit). Of these the French game is much the best:—

WHITE.

1. P to K 4
2. P to Q 4
3. P takes P
4. Kt to K B 3
5. B to K 3

BLACK.

1. P to K 3
2. P to Q 4
3. P takes P
4. Kt to K B 3
5. B to Q B

Each player castles, the positions being even.

The Sicilian defence is less favourable to the second player:—

1. P to K 4
2. Kt to Q B 3
3. Kt to K B 3
4. P to Q 4
5. Kt takes P

1. P to Q B 4
2. P to K 3
3. Kt to Q B 3
4. P takes P
5. P to Q R 3

This latter move is almost forced, and as White gets his pieces into play more rapidly he has somewhat the advantage.

In reply to the Fianchetto, White rapidly occupies the centre of the board:—

1. P to K 4
2. P to Q 4
3. B to K 3
4. P to K B 4, &c.

1. P to Q Kt 3
2. B to Q Kt 2
3. P to K 3

By adopting the centre counter gambit, the second player gets an inferior game:—

1. P to K 4
2. P takes P
3. Kt to Q B 3
4. P to Q 4

1. P to Q 4
2. Q takes P
3. Q to Q sq.

And White develops his pieces rapidly.

The second class of irregular openings are those wherein neither side moves 1. P to K 4. Of these the principal is the queen's gambit, which may proceed thus:—

1. P to Q 4
2. P to Q B 4

1. P to Q 4
2. P to K 3

As a rule, Black does not take the pawn, for White regains it immediately.

3. P to K 3
4. Kt. to K B 3
5. P to Q R 3

3. Kt to K B 3
4. P to Q R 3
5. P to Q B 4

Even game. It is indispensable for both players to move P to Q R 3 early in this opening.

If the learner has patiently followed us to this point, and clearly understood the various situations by working them out, he will now be in a position to pass on to the higher developments of the game. In acquiring a larger knowledge of Chess he will also be able to form an independent opinion as to its merits. His judgment, testimony almost universal warrants us in saying, will probably be that Chess is the king of games.

DRAUGHTS.

THE game of Draughts is played by two persons on a board of sixty-four squares, thirty-two of one colour and thirty-two of another, the board being so placed that each player has a black square at his right-hand lower corner. The men consist of twenty-four discs of wood or ivory, of different colours—usually black and white—each player having twelve pieces. In Fig. 1 the board is placed with the men set for play, and it will be seen that the pieces occupy corresponding positions at each end. They are generally placed on the white squares; but when placed on the black, the position of the board must be so far changed as to bring a white square at each player's lower right-hand corner. In games and problems it is customary to start the black from the top, and the white from the bottom

BLACK.

The pieces move diagonally from square to square, either to the right or left, and never laterally or straightforward. They move forward one square at a time, each player alternately. They *take* in the direction of their moves by passing over the opposing man into the vacant square behind, and not, as in Chess, by occupying the place of the captured piece. The man taken is removed from the board. One, two, or more men may be captured at a single move, provided always that each man so taken has a vacant square behind him. Except, however, when an opportunity occurs of taking a man or men, the pieces move only one square at each step. Immediately a man arrives at any of the four squares in the last opposite row, he is crowned, and becomes a

WHITE.

Fig. 1.—THE "MEN" READY FOR PLAY.

king. The crowning ceremony consists in the placing of another man on the top of the advanced piece. The king has the privilege of moving *either backward or forward*, but only one square at a time. The *object of the game* is to capture the enemy's men, or to so block them in that they cannot move; and the player who first accomplishes either of these objects, wins. The notation of Draughts is shown in Fig. 2.

The only technical term that we need concern ourselves with, is that known as the *huff*. The meaning of this word is, that when a player overlooks a move by which he could take an offered man, his opponent may remove the offending man, or insist on its taking instead. *Standing the huff* is the purposely playing another man instead of taking the one *en prise*, or liable to be taken. In Draughts—just the reverse of Chess—the player has no option, but must always take a man or men *en prise*, irrespective of the consequences. The importance of the rule which obliges the taking of a man, instead of "standing the huff," will be clearly understood from the following position: Suppose white men on squares 28, 24, and 23; and black men on squares 15, 16, and 8; White to move from 24 to 19, then Black would take the offered man, and pass into square 24,

when White would go from 28 to 19, and thence to the vacant squares 12 and 3, taking three men for one. Had Black been allowed to "stand the huff," he would have lost only one man instead of three. Further, suppose that White omitted to take the man on square 8 (a not uncommon mistake), then Black would be allowed to huff the man on 12 and move into the vacant square, or make any other legal move.

THE LAWS OF DRAUGHTS.

1. The board is to be so placed that a white square is at the upper right-hand corner.
2. The choice of colour is to be determined by lot.
3. The black men to have the first move, and after the first game the men to be changed. [By this means each player alternately takes the black men and first move.]

BLACK.

4. The player who touches a man, excepting for the purpose of adjusting it, must move it, if a legal move can be made with that man.

5. A man moved over the angle of a square must be moved to that square.

6. A man *en prise* must be taken.

7. If the man *en prise* be left untaken by accident, the adversary has the option of huffing; or of compelling the capture of the offered piece; or of allowing the offending piece to remain on its square.

8. The huff is not a move, and after the piece is huffed, the player makes his move as usual. [Hence the saying, "Huff and move."]

9. Five minutes is the limit of time for considering a move. [In match games an umpire is appointed to call the time.]

10. When a piece is *en prise*, and there is only one way of taking it, one minute is the maximum time allowed for the move.

11. The penalty for exceeding the time stated, is the loss of the game. [In friendly contests time is not necessarily insisted on.]

WHITE.

Fig. 2 - THE NOTATION OF DRAUGHTS.

12. A player making a false move, must either replace the men and make a legal move, or resign the game, at the option of his adversary.

13. When, in the act of taking, the player removes one of his own men from the board, he cannot replace it without the consent of his opponent, who can either play or insist on the move standing, or of the piece being replaced.

14. When only two kings remain on either side, if neither player can force a win within twenty moves, the game is *drawn*.

15. When three or more kings are opposed to two, the player with the weaker force may claim a draw if his opponent fail to win within forty moves. [The forty moves are counted for each side.]

16. Notice must be formally given of the intention to count the moves.

17. When several pieces are taken by one move, no man must be lifted from the board till the move is completed; and if the player fail to take all the men he can, his opponent may huff him.

18. When a man arrives at the last row of squares on his opponent's side of the board, it must immediately be crowned; and such king cannot be moved until a move has been made by the other player.

19. Pointing over the board, or otherwise annoying or obstructing the opposite player, shall, after due notice, be considered a breach of good manners, and, if persisted in, forfeit the game.

20. All matches, unless otherwise agreed, must consist of an equal number of games.
[This is to give each player the first move an equal number of times.]

21. All disputes to be decided by an umpire, or by the majority of the company present.

22. During the progress of a game neither player is allowed to leave the room without the consent of the other.

23. A breach of any of the above laws to be considered a loss of the game.

We may now proceed to state a few of the general principles which should guide the beginner in his play.

Never touch a man that you do not intend to move. Always play in strict accordance with the laws of the game. Open your game upon a regular plan, whether with a superior or inferior player; by so doing you acquire method in both attack and defence. Before making your move, look well over the board, and endeavour to penetrate the motive of your opponent's play. By discovering the secret of his finesse you are enabled to counteract it. When there is only one way of taking a man, take it without loss of time; nothing is so irritating as unnecessary delay. By no means limit your attack to one sole mode, as you thereby give your opponent an opportunity of judging your strength. Back up your advanced men, and do not be afraid of leaving your last row empty. As a general rule, however, it is well to keep the command of the double corner. A few judicious exchanges at the opening of the game greatly simplify its progress: a crowded board is a frequent cause of embarrassment. When you are a man ahead, you may exchange with impunity; but beware, in so doing, that you do not fall into a trap. Recollect that, with an open game, the possession of one man more than your adversary is a certain win. Avoid all scattering of your forces, and as they get fewer, endeavour to keep them well together—unity is strength. Fortify your position by safe exchanges, and work up for a king as quickly as possible. Play towards the centre of the board, rather than to the sides. If your opponent goes into the side squares, let him, as his freedom of play is much impeded by the limitations of the board; while you, on the contrary, can march onward with comparative safety. Directly you notice that your opponent weakens his double or single corner, endeavour to attack that position, but you must do it with resolution, or you may fail. As he must advance, you are often able to make the first king—a certain and undeniable benefit to your game. But, while working up for a king, move your men so as to prevent your opponent from pushing his pieces too far forward. It is better to exchange than to allow your position to be too fiercely attacked; but wait rather for an opening than attempt a risky move. With a skilful opponent, an ordinary *coup* will generally fail. Directly you perceive that your adversary has become aware of the trap set for him, abandon it, unless you can absolutely force the position, and then try some other plan of attack. When there is no possibility of saving the piece, do not linger over the move, but make it; and endeavour to retrieve your position by another. When surrounded and strongly attacked, it is often better to sacrifice a man than to attempt to defend it. Towards the end of the game, with a man less than the other side, make your kings as quickly as possible, and bear down with them boldly. Three kings against four is a much stronger game than two kings against three. As it is advantageous for the stronger side to exchange, endeavour to avoid being forced, by keeping your kings in a close phalanx (° °) with the side of the board for a base of operations. Play with judgment, choosing a stronger rather than a weaker adversary; do not fatigue yourself with too many games at a sitting; with a tired or pre-occupied mind decline play altogether; never make an attacking move without a motive; avoid remarks upon the game, and especially such as are likely to irritate your opponent; never point over the board or indicate a move or series of moves with your finger; never announce a win in a certain number of moves, unless you are certain

you can accomplish it; avoid satire; win with modesty, and lose with good temper.

As we will have to consider the chief openings of games at some detail, we will discuss the ordinary ways of finishing a game. These should be thoroughly mastered, as, like checkmate in Chess, they are indispensable.

TWO KINGS TO ONE.

The winning with two kings to one, within the stipulated number of moves, is often a matter of difficulty with beginners; but with good players the game is always abandoned when it gets to that point. Suppose the single king to have attained the double corner, his opponent must bring up his two kings to the squares commanding the double corner. This he can do from any part of the board in nine moves at most; and in eight more he can win the game. We assume that a white king stands on square 28, and the two black kings stand on squares 19 and 23. The process is then as follows: If it is White to move, he can go only from 28 to 32, when Black moves from 19 to 24, thus:—

BLACK.	WHITE.
	28 to 32
19 to 24	32 to 28
23 to 19	28 to 32
24 to 28	32 to 27
28 to 32	27 to 31
19 to 15	31 to 26
15 to 18	26 to 30, or 31;
18 to 22	

and White has only to give himself up. The error usually made by young players is for the attacking man to go from 19 to 23 instead of 15, which allows the single man to get into square 27, when Black must retire to either 18 or 19, and begin his attack again. But the move from 19 to 15 leaves the single man nothing to do but retreat. All the moves of the single man, when once the two kings arrive in front of the double corner, are forced. A corresponding series of moves on the other side of the board of course produces a corresponding result.

TWO KINGS TO TWO.

This usually forms a drawn game; for if each player act on the defensive, a win is impossible. If, however, you can force your opponent off the double diagonal line of squares, or otherwise manipulate him, you may succeed in arranging such a position as this: Black kings on 2 and 7, White kings on 14 and 15, when Black plays, and wins by moving from 7 to 10, and securing two for one. But in endeavouring to get this situation, take care not to give what is called the Breeches, by allowing your opponent to place a king between your two kings, one of which you must in that case lose.

THREE KINGS TO TWO.

This position is rather difficult; for, in order to win, it is necessary to effect an exchange. The player with two kings generally moves one into each double corner, and then the proper plan is to bring the three kings into a line, and give one for one. The mode of forcing an exchange is sometimes puzzling to tyros, but, properly conducted, it is sharp and certain.

Suppose Black kings on squares 5 and 32, and White kings on squares 10, 18, and 19; White plays and wins.

BLACK.	WHITE.
	10 to 6
32 to 28	18 to 15
5 to 1	6 to 10

Now it matters not which king Black moves, as he must accept an exchange at White's next move. Or if Black plays 32 to 27 instead, as his reply to White, he still loses. See:—

BLACK.

32 to 27
27 to 24

WHITE.

10 to 6
19 to 23
6 to 9;

And again White makes the exchange. If, on the other hand, Black, at his second move, returns to square 32, 6 to 9 is the reply, forcing the exchange. As soon as the exchange is effected, White wins in the usual way with two to one.

THREE KINGS TO FOUR.

This is a more difficult position, and the man with the weaker force can prolong the game. Presuming that White with four kings has forced Black's three into the following position:—

Black.—Kings on squares 30, 31, and 32.

White.—Kings on 21, 22, 23, and 24.

Black, having to play, has but one move, 32 to 28.

BLACK.

32 to 28
28 to 32
31 to 27
27 to 31*
32 to 27

WHITE.

24 to 20
23 to 19
22 to 18
19 to 24
24 to 28

BLACK.

27 to 32
31 to 27
30 to 23
27 to 31
31 to 24

WHITE.

18 to 23
23 to 26
28 to 24
24 to 27
20 to 18.

And White, with two kings to one, wins in the usual manner. If, instead of this move,* he play 27 to 23, his opponent takes 18 to 27, and wins.

THE OPENINGS.

As in Chess, the openings are highly important features of games. The subjoined list contains those most favoured by players:—

Old Fourteenth.—11 to 15; replied to by 23 to 19; followed by 8 to 11, 22 to 17 and 4 to 8.

Single Corner.—11 to 15; replied to by 22 to 18.

Double Corner.—9 to 14.

Second Double Corner.—11 to 15; replied to by 24 to 19.

Cross.—11 to 15; replied to by 23 to 18.

Will-o'-the-Wisp.—11 to 15; 23 to 19; 9 to 13.

Laird and Lady.—11 to 15; 23 to 19; 8 to 11; 22 to 17; 9 to 13.

Maid o' the Mill.—11 to 15; 22 to 17; 15 to 18.

Fife.—11 to 15; 23 to 19; 9 to 14; 22 to 17; 5 to 9.

Ayrshire Lassic.—11 to 15; 24 to 20.

The first two moves of the *Laird and Lady* become the *Defiance*, when, instead of moving 8 to 11, the player chooses 9 to 14, followed by 27 to 23; the *Whittier*, when the third move is from 7 to 11; and the *Glasgow*, when the fourth move is from 11 to 16.

The two most successful openings are the *Old Fourteenth* and the *Single Corner*. But that known as the *Laird and Lady* is almost equally popular. Here is an example of it:—

BLACK.

1. 11 to 15
2. 8 to 11
3. 9 to 13 var. 1
4. 10 to 17
5. 15 to 18
6. 13 to 17
7. 4 to 8

WHITE.

1. 23 to 19
2. 22 to 17
3. 17 to 14
4. 21 to 14
5. 26 to 23
6. 19 to 15
7. 23 to 19

BLACK.

8. 6 to 9
9. 1 to 6
10. 9 to 13
11. 6 to 15
12. 11 to 15
13. 8 to 11
14. 18 to 25

WHITE.

8. 24 to 20
9. 28 to 24
10. 15 to 10
11. 19 to 10
12. 31 to 26
13. 25 to 22
14. 29 to 22

BLACK.	WHITE.	BLACK.	WHITE.
15. 11 to 16	15. 20 to 11	22. 26 to 31 K	22. 8 to 4 K
16. 7 to 16	16. 26 to 23	23. 31 to 26	23. 4 to 8
17. 17 to 26	17. 23 to 19	24. 26 to 22	24. 8 to 11
18. 16 to 23	18. 27 to 11	25. 22 to 18	25. 32 to 28
19. 13 to 17	19. 30 to 23	26. 18 to 9	26. 10 to 6
20. 17 to 22	20. 23 to 19	27. 3 to 7;	
21. 22 to 26	21. 11 to 8		

and the game is drawn.

The following is the position of the men:—Black men on 2, 5, 7, 12, and a king on 9; White men on 6, 19, 24, 28, and a king on 11. Black must now accept a draw; for, if he is not very careful, he will lose the game if he continue it beyond this point.

Now let us see what would have been the effect had Black, at his third move, gone from 4 to 8, instead of from 9 to 13.

BLACK.	WHITE.	BLACK.	WHITE.
	Moves 1 and 2 on each side as before.		
3. 4 to 8	3. 17 to 13	14. 13 to 17	14. 22 to 13
4. 15 to 18	4. 24 to 20	15. 8 to 12	15. 24 to 19
5. 11 to 15	5. 28 to 24	16. 15 to 31 K	16. 26 to 22
6. 8 to 11	6. 26 to 23	17. 12 to 19	17. 22 to 8
7. 9 to 14	7. 31 to 26	18. 14 to 17	18. 21 to 14
8. 6 to 9	8. 13 to 6	19. 10 to 17	19. 8 to 3 K
9. 2 to 9	9. 26 to 22	20. 7 to 10	20. 25 to 21
10. 1 to 6	10. 32 to 28	21. 17 to 22	21. 20 to 16
11. 3 to 8	11. 30 to 26	22. 10 to 14	22. 16 to 11
12. 9 to 13	12. 19 to 16	23. 31 to 26	23. 11 to 8
13. 12 to 19	13. 23 to 16	24. 26 to 30;	

and the game is again a draw; the variation having converted the Laird and Lady into the

OLD FOURTEENTH OPENING.

The position of the men at the finish is as follows:—Black men on 5, 6, 14, 19, 22, and king on 30; White men on 8, 13, 21, 28, 29, and king on 3.

Let us pursue our game a little farther. Suppose that, instead of moving from 17 to 13, White at his third move had played from 25 to 22, he would have altogether altered the character of both the attack and the defence. See:—

BLACK.	WHITE.	BLACK.	WHITE.
	Moves 1 and 2 on each side as before.		
3. 4 to 8	3. 25 to 22	10. 11 to 16 var.	10. 24 to 20
4. 15 to 18	4. 22 to 15	11. 1 to 6	11. 20 to 11
5. 11 to 18	5. 17 to 13	12. 7 to 16	12. 26 to 22
6. 9 to 14	6. 29 to 25	13. 2 to 7	13. 22 to 17
7. 10 to 15	7. 19 to 10	14. 7 to 10	14. 23 to 19
8. 6 to 15	8. 26 to 23	15. 16 to 23	15. 25 to 22
9. 8 to 11	9. 30 to 26	16. 18 to 25	16. 27 to 2 K;

and White wins. The position at the finish is this, from which it will be seen that Black's game is hopeless:—Black men on 3, 5, 10, 12, 15, 25; White men on 13, 17, 21, 28, 31, 32, and king on 2.

But where did Black fail? Why, at the eleventh move, 1 to 6. And we find that White, from that position, wins, in spite of many variations. Play the game up to the tenth move, Black as before, and, however Black struggles, he loses:—

BLACK.	WHITE.	BLACK.	WHITE.
	Moves 1 to 10 as in last game.		
10. 11 to 16	10. 24 to 20	15. 7 to 16	15. 27 to 11
11. 7 to 11	11. 28 to 24	16. 18 to 27	16. 32 to 23
12. 3 to 7	12. 24 to 19	17. 2 to 6	17. 11 to 7
13. 15 to 24	13. 26 to 22	18. 6 to 10;	
14. 11 to 15	14. 20 to 11		

and White wins from the following position :—Black men on 1, 5, 10, 12, 14, 15; White men on 7, 13, 21, 22, 23, 25, 31.

Again we may try a variation :—

BLACK. WHITE.
The moves to the variation on each side the same as before.

12. 2 to 6	12. 24 to 19
13. 15 to 24	13. 26 to 22
14. 11 to 15	14. 20 to 11
15. 24 to 28	15. 11 to 8
16. 12 to 16	16. 22 to 17
17. 3 to 12	17. 17 to 1 K;

and, once more, White wins, with the following position :—Black men on 2, 5, 12, 15, 16, 18, 28; White men on 13, 21, 23, 25, 27, 31, 32, and king on 1.

From all this—and we might multiply the variations indefinitely—we see that White's third move should be 17 to 13, and not 25 to 22. But, if either player make the slightest mistake in his opening, it is fatal, as we may see in this next example :—

BLACK.	WHITE.	BLACK.	WHITE.
1. 11 to 15	1. 23 to 19	10. 11 to 16	10. 20 to 11
2. 8 to 11	2. 22 to 17	11. 7 to 16	11. 25 to 22
3. 4 to 8	3. 17 to 13	12. 18 to 25	12. 29 to 22
4. 15 to 18	4. 24 to 20	13. 3 to 7	13. 22 to 18
5. 11 to 15	5. 28 to 24	14. 15 to 22	14. 19 to 15
6. 8 to 11	6. 26 to 22 var.	15. 10 to 28	15. 17 to 3 K
7. 9 to 14	7. 31 to 26	16. 22 to 26	16. 3 to 8
8. 5 to 9	8. 26 to 23	17. 16 to 20	17. 23 to 18
9. 1 to 5	9. 22 to 17	18. 26 to 31 K;	

and Black wins; as he changes to advantage, as may be plainly seen by a glance at the position :—Black men on 2, 5, 6, 9, 12, 20, 28, and king on 31; White men on 13, 18, 21, 27, 30, 32, and king on 8. White's losing move was his sixth. Had he not so precipitately gone from 26 to 22, he might have had a winning game. This may be easily demonstrated :—

BLACK	WHITE.	BLACK	WHITE.
Moves 1 to 6 as before, with the difference that White moves from 25 to 22, instead of 26 to 22.			
7. 18 to 25	6. 25 to 22	12. 3 to 8	12. 23 to 18
8. 9 to 14	7. 29 to 22	13. 14 to 23	13. 31 to 27
9. 6 to 9	8. 27 to 23	14. 15 to 18	14. 22 to 6
10. 2 to 9	9. 13 to 6	15. 13 to 22	15. 27 to 18
11. 9 to 13	10. 22 to 17	16. 1 to 10	16. 18 to 14
	11. 26 to 23	17. 10 to 17	17. 21 to 14;

and White wins, as Black cannot move without losing a man. The position is indeed a curiosity :—Black on 5, 7, 8, 11, 12, 22; White on 14, 19, 20, 24, 30, 32.

Taking now the SINGLE CORNER OPENING, let us play a game together :—

BLACK.	WHITE.
1. 11 to 15	1. 22 to 18
2. 15 to 22	2. 25 to 18
3. 8 to 11	3. 29 to 25
4. 4 to 8	4. 25 to 22
5. 12 to 16	5. 24 to 20
6. 10 to 15	

The usual move now is 27 to 24, in order to endeavour to get two for one, but the move is not sound, as, if Black play the game without mistake, he wins. The better move is

7. 7 to 10	6. 21 to 17
	7. 27 to 24;

Black must now move from square 8 to 12, or he will lose a man, thus :—White,

24 to 19; Black takes the man, and passes from 15 to 24, when White takes two—28 to 12. The black therefore plays

BLACK.	WHITE.	BLACK.	WHITE.
8. 8 to 12	8. 17 to 13	18. 16 to 30 K	18. 25 to 21
9. 9 to 14	9. 18 to 9	19. 10 to 17	19. 21 to 14
10. 5 to 14	10. 24 to 19	20. 30 to 25	20. 14 to 9
11. 15 to 24	11. 28 to 19	21. 11 to 15	21. 9 to 6
12. 14 to 17	12. 32 to 27	22. 2 to 9	22. 13 to 6
13. 10 to 14	13. 27 to 24	23. 15 to 18	23. 6 to 2 K
14. 3 to 7	14. 30 to 25	24. 7 to 10	24. 2 to 6
15. 6 to 9	15. 13 to 6	25. 10 to 14	25. 6 to 9
16. 1 to 10	16. 22 to 13	26. 25 to 21	26. 31 to 26
17. 14 to 18	17. 23 to 14	27. 14 to 17,	

and the game is drawn; the following being the position of the men:—Black men on 12, 17, 18, and king on 21; White men on 20, 24, 26, and king on 9. If White move from 9 to 14, Black moves from 18 to 22; and escapes. It will be as well, seeing that in this game neither party can claim the victory, to vary the move of White and try its effect. Beginning with the same two moves as before, the game will be seen to assume a perfectly different aspect.

SINGLE CORNER—GAME II.

Moves 1 to 5 as in game 1.

BLACK.	WHITE.
1. 11 to 15	1. 22 to 18
2. 15 to 22	2. 25 to 18

and now, instead of the previous move, Black goes from square 12 to 16, see:—

BLACK.	WHITE.	BLACK.	WHITE.
3. 12 to 16	3. 29 to 25	13. 10 to 17	13. 23 to 19
4. 16 to 20	4. 25 to 22	14. 16 to 23	14. 26 to 19
5. 8 to 11	5. 24 to 19	15. 9 to 14	15. 18 to 9
6. 4 to 8	6. 28 to 24	16. 5 to 14	16. 32 to 28
7. 10 to 14	7. 19 to 16	17. 11 to 16	17. 19 to 15
8. 6 to 10	8. 16 to 12	18. 7 to 10	18. 15 to 6
9. 11 to 16	9. 22 to 17	19. 1 to 10	19. 27 to 23
10. 8 to 11	10. 17 to 13	20. 20 to 27	20. 31 to 24
11. 14 to 17	11. 13 to 6	21. 16 to 20	21. 24 to 19
12. 2 to 9	12. 21 to 14		

And once more White draws the game, with the following position of the men:—Black on 3, 10, 14, 17, 20; White on 12, 19, 23, 28, 30. It will be seen that Black, now having to move, can do no more than move from 17 to 21, 3 to 7, or 20 to 24; and White, in reply, can only go forward to king, with no material advantage on either side. This opening is therefore a good one for the first player. Suppose the first five commencing moves to be as in the first game; but White, at his sixth move, to play 27 to 24, as suggested, instead of 21 to 17; this then is the position of the men:—Black on 1, 2, 3, 5, 6, 7, 8, 9, 11, 15, 16; White on 18, 20, 21, 22, 23, 26, 27, 28, 30, 31, 32. White has now to play, and he moves 27 to 24; let us see what is the result.

SINGLE CORNER—GAME III.

Moves 1 to 5 as in game 1.

BLACK.	WHITE.	BLACK.	WHITE.
6. 10 to 15	6. 27 to 24	17. 15 to 18	17. 24 to 20
7. 16 to 19	7. 23 to 16	18. 18 to 27	18. 31 to 24
8. 15 to 19	8. 24 to 15	19. 14 to 18	19. 16 to 11
9. 9 to 14	9. 18 to 9	20. 7 to 16	20. 20 to 11
10. 11 to 25	10. 32 to 27	21. 18 to 23	21. 11 to 8
11. 5 to 14	11. 27 to 23	22. 20 to 27	22. 8 to 4 K
12. 6 to 10	12. 16 to 12	23. 27 to 31 K	23. 4 to 8
13. 8 to 11	13. 28 to 24	24. 31 to 27	24. 24 to 20
14. 25 to 29 K	14. 30 to 25	25. 27 to 23	25. 8 to 11
15. 29 to 22	15. 26 to 17	26. 23 to 18	26. 11 to 8
16. 11 to 15	16. 20 to 16	27. 18 to 15	

and Black wins, this being the position:—Black on 1, 2, 3, 10, and king on 15; White on 12, 17, 20, 21, and king on 8.

We see that the series of moves which followed enabled Black to make a king very readily, which, however, he loses directly it is crowned. After this both sides, in a few moves, make kings. White's position at the finish is, to say the least of it, very awkward. He might, to be sure, have moved from 11 to 16, instead of retiring to square 8, but he would still have had so much the worse of the game, that he could not recover it. He must lose, play as well as he may.

If, instead of playing 23 to 18 at his second move, White reply by 23 to 19, the opening becomes

THE WHITTIER,

by many considered a strong and safe defence. Let us see:—

BLACK.	WHITE.	BLACK.	WHITE.
1. 11 to 15	1. 23 to 19	11. 16 to 20	11. 30 to 26
2. 8 to 11	2. 22 to 17	12. 5 to 9	12. 21 to 17
3. 4 to 8	3. 17 to 13	13. 7 to 10	13. 25 to 21
4. 9 to 14	4. 25 to 22	14. 10 to 14	14. 17 to 10
5. 14 to 18	5. 29 to 25	15. 2 to 7	15. 26 to 23
6. 11 to 16	6. 26 to 23	16. 7 to 14	16. 22 to 17
7. 8 to 11	7. 23 to 14	17. 15 to 22	17. 17 to 10
8. 16 to 23	8. 27 to 18	18. 6 to 15	18. 13 to 6
9. 10 to 26	9. 31 to 22	19. 1 to 10	
10. 12 to 16	10. 32 to 27		

and Black wins, with the following disposition of the men:—Black on 3, 10, 11, 15, 20, 22; White on 21, 23, 24, 27, 28.

If, instead of moving 8 to 11, at his second move, Black go from 9 to 14, he only succeeds in obtaining a draw:—

1. 11 to 15	1. 23 to 19	15. 12 to 19	15. 23 to 16
2. 9 to 14	2. 22 to 17	16. 15 to 19	16. 25 to 22
3. 6 to 9	3. 17 to 13	17. 19 to 24	17. 26 to 23
4. 2 to 6	4. 25 to 22	18. 24 to 28	18. 23 to 19
5. 8 to 11	5. 29 to 25	19. 8 to 12	19. 16 to 11
6. 4 to 8	6. 22 to 17	20. 28 to 32 K	20. 11 to 8
7. 14 to 18	7. 26 to 23	21. 32 to 28	21. 8 to 4
8. 9 to 14	8. 24 to 20	22. 28 to 24	22. 20 to 16
9. 15 to 14	9. 28 to 19	23. 24 to 15	23. 16 to 11
10. 5 to 9	10. 22 to 15	24. 15 to 8	24. 4 to 11
11. 11 to 18	11. 27 to 23	25. 14 to 18	25. 22 to 15
12. 18 to 27	12. 32 to 23	26. 10 to 19	26. 31 to 27
13. 7 to 11	13. 30 to 26	27. 11 to 16	
14. 11 to 15	14. 19 to 16		

and the result is a draw; for if Black move any other man he must still lose, as will be seen by an examination of the position at this point:—Black on 1, 3, 6, 9, 16, 19; White on 13, 17, 21, 27, and king on 11. White had the power of moving from 11 to 15, recovering his man, and drawing the game, even supposing that, instead of moving 12 to 16, Black had gone from 1 to 5, his only apparently safe move. But suppose Black, at his tenth move, had gone from 11 to 15, instead of from 5 to 9, he would, as we will see, have lost:—

Nine moves on both sides as before.

10. 11 to 15	10. 32 to 28	15. 3 to 7	15. 19 to 16
11. 15 to 24	11. 28 to 11	16. 12 to 26	16. 31 to 15
12. 7 to 11	12. 22 to 15	17. 10 to 19	17. 17 to 3 K
13. 11 to 18	13. 30 to 26	18. 19 to 24	18. 3 to 12
14. 6 to 9	14. 26 to 23	19. 24 to 31 K	

White has now a man ahead, and wins perforce:—Black on 1, 6, 9, and king on 31; White on 13, 20, 21, 25, and king on 12.

The foregoing openings will be more useful to our readers than elaborate problems, which, though exciting and full of interest, could not possibly be of the same service to them in a practical study of the game.

MINOR SKILLED GAMES.

We will now take up what may be called the minor indoor skilled games. The descriptions and instructions for the most part are written on the supposition that the games will be played with the materials and on the boards supplied from the toy-shops. It will be found, however, that suitable materials of a simple nature may be made with but very little trouble, and for the majority of the games will be as well adapted as any other.

AGON, OR QUEEN'S GUARDS.

The game of "Agon" is in some respects, notably the moving forward only of the ordinary pieces, similar to the game of draughts. As, however, in this game pieces are not lost, every piece is of equal importance, and the whole attention of the players is throughout fixed more on the game as a whole than on individual pieces. The object of the game is to attain to a certain

position on the board; and unless all the pieces are so played as to be simultaneously workable at the right time for winning, all the previous play counts for nothing. The game is for two players only, and it is played upon a hexagonal board, divided into hexagonal compartments. The players have each seven pieces, viz., one queen and six guards; hence the second name of the game, "Queen's Guards." To commence the game, the pieces which are respectively light and dark are to be arranged by placing the two queens at opposite corners of the board, with the guards arranged around the board, a guard of each colour being alternately placed, one compartment being left vacant between each piece.

Fig. 1.—AGON BOARD PLACED FOR PLAYING.

Fig. 1 shows the pieces ready placed for the commencement of the game, and it will be seen that at the points most distant from the queens on either side of the board two of the hexagonal compartments are left blank. As an alternative to placing the pieces in this way, it is sometimes agreed that each player, the one taking the dark pieces and the other the light, should alternately place one piece on the board in any position he chooses, and then when all the pieces are placed the moving commences, and is carried on in the ordinary manner as described below. The pieces being placed as first described, the players select their respective colour, and decide who shall have first move, and they then move alternately. The pieces are moved only towards the centre, one compartment at a time; or the pieces may be moved to any adjoining compartment, provided that when moved no piece is farther from the centre than it was before the move was made: that is to say, a piece may be moved either one compartment forward or the compartment sideways.

If during the game any piece other than the queen should be between two of the pieces of the opposite side, in such a position that the three pieces are in a line, such piece must, for the next move, be taken up and placed at some compartment in the outermost row.

If the queen should be similarly placed for the next move, it must also be

taken up, but may be placed on any compartment of the board that may happen to be vacant.

The object of the game is to place the queen in the centre compartment, with all the six guards of the same colour posted round her in the circle adjoining the centre compartment (Fig. 2).

The following are the recognised laws of the game:—

1. None but the queens are to occupy the centre compartment.
2. No piece may be put between two of the adversary's standing in a right line. (Penalty, see above.)
3. No piece may be moved backward other than as a penalty for the breach of Rule 2.
4. Of two or more pieces liable to be put back at one time if the queen be one of them, she is first to be taken up; others to be removed one each move, at the option of the player.
5. If a piece be touched preparatory to moving, that piece must be moved or the move be lost.
6. If the six guards are placed in the circle immediately surrounding the centre compartment, leaving the queen outside, the player so having his pieces placed forfeits the game, as both are by that means prevented from attaining the primary object of the game.

The following hints as to how the game is played will be useful:—No advantage is gained, but, on the contrary, frequently a loss, by throwing back one only of an adversary's pieces, as the piece thrown back may generally be so placed as more readily to attain a better position than that from which it is removed. Each player should try for such a position that in successive moves he may be enabled to throw back several of his opponent's pieces, and so get on with all his pieces together to the middle before he can be overtaken. Again, as no piece may be moved backwards, it is not advisable to push forward the queen too hastily, as more strength follows upon a concentration of all the pieces. It will, however, generally be found advantageous, particularly during the earlier stages of the game, to have one piece at a greater distance from the centre than is any one of the opponent's pieces, care always being taken to be in a proper position to get to the middle when the game approaches a crisis.

Fig. 2 - DIAGRAM SHOWING POSITION OF MEN AT END OF A GAME.

The game is amusing and ingenious, and although but little known, is well worth study and practice. The variety of situations attained in playing it are so numerous as to preclude any possibility of its being condemned on the score of monotony. The uncertainty of the game, too, is such that until one side is altogether vanquished the opponent can never be sure of victory.

BACKGAMMON.

Backgammon is a game played by two persons with dice upon a board, or table (as it is technically termed), divided into two parts, upon which there are twelve points of one colour and twelve of another, usually a contrast of light and dark, the points of the different colours being alternately placed. Each player has fifteen men or pieces of different colours, and should have for his own use two dice and a dice-box.

The players should sit opposite each other at either end of the board, so that the numbers 1, as shown in the diagram of a backgammon board, are to the left of one player and to the right of the other, the fifteen pieces, at the commencement of the game, being placed as follows:—Two men are to be placed upon the ace point on the adversary's inner side of the board, and five on the sixth point (that numbered 12 in the diagram) of his outer table; three on that point of the player's own outer table that is numbered 8, and five on the sixth point of the player's inner table.

The object of the game is for each player to get all his men played round into his inner table, removing them from point to point, according to the throws of the dice, which are taken alternately, and finally moving the men off the board. The player who first gets all his men off wins the game.

The following are the laws of backgammon, as given by Hoyle:—

1. If you take a man from any point, that man must be played; the same must be done if two men are taken from it.

2. You are not understood to have played any man until you have placed him upon a point and quitted him.

3. If you play with fourteen men only, there is no penalty attending it, because by playing with a less number than you are entitled to you play at a disadvantage, by not having the additional man to make up your tables.

4. If you bear any number of men before you entered a man taken up, and which, consequently, you were obliged to enter, such men so borne must be entered again in your adversary's tables, as well as the man taken up.

5. If you have mistaken your throw and played it, and if your adversary has thrown, it is not in your or his choice to alter it, unless both parties agree thereto.

The following is a list of some of the technical terms employed in talking of or describing the game,

Backward Game is one in which a player has not succeeded in moving his men as far onward as his opponent.

Bar is the division between the inner and outer tables.

Bearing the men is the removing them from the inner table when they have all been brought round.

Blot is a single man left on any point.

Carrying the men is removing them from point to point, according to the numbers shown by the dice when duly thrown.

Covering a man is a move by which a player is enabled to place another man in front of a single man or blot, and by that means preventing the adversary from *hitting a blot*.

Doublets, a throw of two dice when each is of equal value.

High Doublets, double five or double six.

Entering a man is replacing a man after being *hit*.

Forward Game is the reverse of a *backward game*.

Points are the several divisions of the table.

A man cannot be carried to any point on which are two or more of the adversary's men.

The right to the first move is usually settled by the throw of one die, the thrower of the highest number taking the first move. He then throws both his dice, and in throwing, the number upon each die may be reckoned separately or collectively with the number on the other die. Thus, if four be thrown by one and six by the other, one man can be advanced four points and another six points, or one man may be advanced ten points—always, of course, provided that the necessary point or points are open to allow of such moves being made. When a pair is thrown by the dice, double is counted; for instance, two sixes will enable the player to move four men each six points forward, or two men each twelve points, or one man the whole twenty-four points, if the adversary has left the position vacant. The men must be moved from the opponent's inner table, through his outer table, into one's own outer table, and thence home into the

inner table. The outer tables are those bearing the numbers 7 to 12 on the diagram, and the inner tables are those bearing the numbers 1 to 6.

When a single man occurs on a point he is called a "blot," and may be taken by the opposite player, if he can manage to "hit" the "blot" by bringing one of his men to this point. In this way he takes and places the "blot" on the bar or division of the table, and the player who owns the "blot" cannot move until he has made a throw which will enter this single man on the table again. This can only be done when a number that is vacant is thrown, or left a "blot" on the adversary's inner table; play counting from a point off the board adjoining the adversary's ace point. "Hitting a blot" always adds considerable interest and excitement to the game, especially when most of the points on the opposite inner table are covered, as it then becomes very difficult to enter, and yet the "blot" is bound to remain on the bar until the adversary leaves some point which may be gained by a throw.

If during the game every point on which a man could be placed is covered by the men of the opposite side, play must wait until a point on the opposite side is opened. After all the men have been brought home into the inner board, they must be taken off the board or "borne." Every number thrown enables a man to be taken off, according to the throw. When the opposite side is waiting for "blots" to enter his men, care to avoid having any "blots" should be taken while the men are being borne. If higher numbers are on the dice than are on the points, men may be taken from any lower point to "bear off" the board.

BACKGAMMON BOARD.

There are three different kinds of wins, viz., the *hit*, the *gammon*, and the *backgammon*. The player who has played all his men round into his own inner table, and by fortunate throws of the dice has borne all his men, wins the *hit*. The *gammon* is as follows:—When one player has moved all his men round into his own table, covering every point, his adversary having a man out, and such player is enabled to lift his men away by throwing the dice and removing all the men before the opponent has borne off one man, the *gammon*, which equals two *hits*, is won. If, on the contrary, the adversary manages to bear but one man, then the victory becomes reduced to a *hit* only. If the winner has borne all his men before the loser has carried all his men to his own table, the *backgammon* is made, which scores equal to three *hits* or a *gammon* and a half.

Backgammon is generally played three up: that is, three *hits*, a *gammon* and a *hit*, or a *backgammon* for game. The best two games out of three win the rub, as usual.

The following hints and directions, if followed, will be found useful in playing the game, but it should be remembered that backgammon is to be indulged in for amusement only, and then it is a really delightful pastime, but if once the gambling element is introduced, the board should at once be put aside. The game should on no account be played for money, for be the stakes never so small, the temptation to increase them is of the surest growth, and the risk of the

loss, not only of money, but what is far more valuable, of reputation, will most assuredly be incurred. To play safely, the great object in the first place should be the *cinq*ue point on both boards, if possible; if this is attained, play a pushing game, endeavouring to win a *gammon*. If playing for a *hit* only, and the player's own tables are made up, it will be safer to take up one or two only of the adversary's men rather than more. In playing for a *gammon*, be careful not to crowd the game at any time, if it can be avoided. By crowding a game is meant placing a number of one's own men on the twos or deuce points in one's own tables, which experience will show is not much better than losing them. The average number likely to be thrown at one throw with two dice is eight.

DOMINOES.

The ordinary games of Dominoes are played with twenty-eight pieces, plain on the back, the faces of which are divided in the middle by a line, on each side of which are blanks or spots, ranging from double blank to double six. Other sets, however, are sometimes used, containing fifty-two pieces, which range up to double nine, and others which contain eighty-five pieces, and range up to double twelve.

In playing, the cards or dominoes have first to be shuffled, the faces being turned downwards on the table, when each player draws one to determine who shall play or *pose* first. The lowest draw wins. There are also other modes of determining the first player; but this is the best, and the one ordinarily used.

There are very many different games at Dominoes—in fact, they are almost as various as the games playable with ordinary cards. Some of the most practised and better known games will be described here, it being left to players themselves to originate varieties on them.

The most common Domino game for two is played in the following manner, and is known as the *Block Game*, or sometimes as *Double Sixes*:—The dominoes are placed on the table, faces downwards, and the first *pose* decided as above described. The two dominoes so used are then to be put back with the others and well shuffled, each player then taking for his share seven dominoes. These are ranged upright in a line on the table, or are held in the hollow palm of the player's hand, with the faces of the dominoes so placed that they may be seen by the player, but not by the player's adversary. Fourteen out of the twenty-eight dominoes will thus be disposed of; the remaining fourteen are left on the table faces downward, and are called the reserve. The winner of the *pose* now puts down on the table, face upwards, that domino which it best suits him to play, his adversary in turn placing a domino which must correspond in one of its numbers with that already placed. For example: taking it that the first player has placed the double six, the second the six-four, the first then may place to the double six another of the six combination, say a six-five; or, failing that, a card of the four combination may be placed to the four of the six-four placed by the second player. So on, each player alternately placing a piece to one or other of the ends until one or other of the players is unable to play, when his opponent is allowed to take the turn. When a player has to stop playing in this way owing to the fact of his having no domino that will match at either end of the placed dominoes, he calls "a go"; but whenever his turn to play again comes round, his opportunity to play returns, and frequently he is then able to do so, as in the meantime the other player may have so continued the game as to leave one or other of the ends open to him who first called "a go." The game is won when either of the players has played out all his dominoes, and cries "Domino!" or, when neither can play, he wins the game whose cards show the smallest number of pips, after each player has added together the pips of the dominoes he holds. There is another way of scoring game by fixing upon

a given number to be game—say 50, 60, or 100, the latter being the favourite number. The number is made up by counting the pips on the cards remaining, he having the smaller number of pips scoring the difference between the pips shown on his dominoes and those on his antagonist's. For example: when a *block* arrives—that is, when neither player can *pose*—each tots up the total of the pips on his dominoes, and if A counts 7 and B counts 12, A would thus score 5 towards game. If one player runs out, or places all his dominoes, he then scores the number of pips shown on his opponent's remaining cards.

The following hints and directions should be observed in playing the *Block Game*:—Upon turning up the seven cards at the commencement of the game, carefully note their numbers, and remember that each player's object is to get rid of as many dominoes as he can, and so play as to block his opponent as early as possible. Play therefore, for preference, those cards having numbers that are most frequently found in the player's hand, as the larger the proportion of any number held in one hand the greater are the chances that none or few of the corresponding cards will be held by the adversary. Again play, for preference, those cards bearing the largest number of pips, in order to secure as much advantage as possible when counting for game. Retain doubles in the hand as little as possible, remembering that they are just twice as difficult to place as an ordinary card. Therefore, if you hold a double and have the lead, lead off with it.

The *Draw Game* is similar in principle to the *Block Game*, except that when the *block* occurs the player blocked has the right to draw or not to draw, as he pleases, one card at a time from the reserve. If, however, such cards cannot be placed, they are to be retained in the hand of the player drawing them, and so are liable to count towards the adversary's game. When a player finds himself blocked early in the game, it is generally advisable to draw upon the reserve, as it is also when pips shown on the cards held bear high numbers. It is difficult, however, to lay down any general directions as to how far it is wise or the reverse to draw from the reserve; this depends so much upon the cards exposed, and nothing but experience will teach effectually on this subject. The last two cards in the reserve must always be left, and a rule is sometimes made that if a player commences to draw upon the reserve, he is bound to persevere until he succeeds in drawing a domino that can be played, or until two dominoes only remain. In the *draw game*, a player calling "a go" has another chance to play so soon as his opponent has played, and does not, as in the *block game*, have to sacrifice his turn to play to his opponent. Skill and experience in dominoes are essential to ensure success in playing the games applicable thereto; and although by many the very name of domino seems to savour of childishness or frivolity, or both, it will be found that the block and draw games alone are well worthy of considerable attention and study; and for that purpose, and for those willing to take some pains to become proficient in a game that is capable of fascinating and interesting the players by its sure combination of skill and chance, the following general maxims or instructions have been drawn up, in addition to the hints and directions previously given:—

1. Every player should play so as to keep both ends open to himself as long as possible. This will, of course, ensure a "go" next time.

2. He should also contrive so to play that the numbers at both ends shall correspond with those dominoes of which he holds the most. This renders a block to the opposing player more probable.

3. Sometimes it will be found that an advantage accrues to the holder of high-numbered dominoes, as they sometimes lead to what is known as a good "follow"; but before it is decided to retain such dominoes until towards the end of the play, it must be seen that they will follow one on the other, and that while a player is blocking his adversary he is not at the same time blocking himself.

4. When doubles with other corresponding numbers are held, they should, as far as possible, be played consecutively, the double being, as previously hinted, played first.

5. When holding several doubles, a player should wait for his opponent to make the numbers for them to be played upon rather than making the numbers for himself; otherwise the opponent, seeing what is being played for, will *block* against the doubles. If, however, the number upon which a double can be placed can be made at both ends, the player holding the double should so make it.

6. If a player holds the double of the number of the end at which his opponent cannot *pose*, the other end should as long as possible be played for preference, as when blocked at that end the player will still be able to play his double.

7. Always when an opponent is blocked at one end prefer to *pose* at the other.

8. A heavy or highly-numbered hand is not necessarily at a greater disadvantage than a light hand, as provided the numbers run well one upon the other it may play out; it is only when the game is blocked that high numbers are disadvantageous.

9. With equal hands and equal players, the first player has the advantage. Therefore, after the first round each player should alternately play or *pose* first.

10. Always make it an object to bring both ends to correspond with dominoes of which the player has several similarly numbered.

11. Always watch the dominoes played, to form a judgment as to the remaining cards of a given number likely to be still out.

12. A player holding a heavy hand should endeavour to avoid a block, and try his best to keep both ends open.

13. The first maxim in the best of all the card games (*Whist*) is, "Don't talk, and don't lose your temper." The same maxim may be applied to dominoes, and placed either first or last, or at both ends, it is as applicable to dominoes as it is to whist. Indeed, and in conclusion, so far as the ordinary and most popular domino games are concerned, it may safely be said that if dominoes seek a successful rival, they must go to cards, and then it is only whist that offers such a variety and such a life-like combination of skill and chance as will be found in the truly royal game of dominoes.

So much for the ordinary *block* and *draw* domino games; but it must not be supposed for one moment that all the merits of dominoes have been here set down. As whist in the card games is but the king of the card games, so with dominoes the king of the domino games has only been described; there still remain the lords and barons of various ranks, the titled subjects of subordinate ranks, and the subjects of no rank at all.

Before proceeding further, a few remarks should be made as to the French versions of the games already described, it being borne in mind that it was from France that dominoes were introduced into civilised modern society, and therefore that the French system may perchance contain merits not yet ingrafted upon the Saxon stock. The lead in France is given to that player who holds the highest double domino, or in the event of there being no double, to the holder of the highest numbered domino. In the drawing game, should the second player be unable to *pose*, he is at liberty to withdraw at once from the reserve all the dominoes but two, or any portion of the reserve he may choose. If, however, he leaves more than two, the first player may, if he wish, appropriate all remaining but two. The French method of counting towards game also is different from that given above. A player having played out, or "made domino," as it is technically called, scores, as in the English game, the pips remaining in his opponent's hand; but in the event of neither having played out, he holding the lowest number of pips scores that number *added* to the number held by his opponent, and not the difference between the numbers, as in the English versions of the game.

Among the other domino games are the *Matadore* game, in which all the dominoes are turned on their faces and shuffled, and from which each player takes but three dominoes, the remainder going to form the reserve. A domino can only be played, unless it should be a *matadore*, when it matches the end of the domino previously played, and against which it is placed. *Matadores*, which may be played at any time irrespective of the previous dominoes placed, are those

dominoes which themselves bear on their faces seven pips or the double blank. The matadores, therefore, in the ordinary domino sets are only four, and are the

Six-one,
Five-two,

Four-three, and
Double-blank.

The holder of the domino bearing the highest number leads, and if the next player cannot play, he must draw from the reserve until he can play, retaining in his own hand the unplayable cards. And so on the game proceeds, always bearing in mind that the last two dominoes must be left in reserve. He who plays out first, or "makes domino," wins the game; but if the game be blocked, as it generally will be, that player who holds the least number of pips scores the number of pips held by his opponent towards game. A game scores just such a number as may be agreed upon, and varies usually between twenty and a hundred. A matadore when played scores one, and one is also scored for every seven or multiple of seven that appears jointly at the opposite ends of the placed dominoes. Thus a double six and a double one, making fourteen, would score two towards game. The following directions will be found specially applicable to the matadore game:—1. It being, of course, impossible to make a seven against a blank, one of the leading objects of this game is to play so as to leave blanks for the opposite player, and so to block him from making a seven. 2. If there is any reason to suppose that the blanks are held by the opposing player, prevent them from being played as far as is possible. 3. Never pose a blank unless holding a matadore or a corresponding blank.

The matadore game is more generally played with those sets of dominoes which range at least up to the double nine. Of course matadores are more numerous in the large pack, the double seven scoring as a double matadore.

Another very capital domino game is that of *Domino Pool*, and it may be played by not more than four players, divided equally, and acting together as partners, or by the players separately. Each player takes five dominoes, the holder of the highest numbered domino being in this game entitled to the lead. In the event of one player not being able to go, the next in turn plays, and so on.

The game is usually played for a pool, which is made up of subscriptions from the different players, and the scoring for game is arranged in the following manner:—So soon as one player has played out, the pips on the cards held by the remaining players have to be counted, and the number held by each player is scored against his name, and a similar record is kept when all the players are blocked. The number of pips to put a player out should be decided before the game is started, and may conveniently be as high as a hundred. A system of "starring" is allowed, after the fashion of "starring" in the Billiard Pool game. A player being out is allowed to "star" by paying again to pool the amount of his original contribution; but no player is compelled to "star," nor can the last two surviving players "star." The player who "stars" re-enters the game with a score against his name equal to that of the player who has the highest score, that is, of him who is of the remaining players in the worst position. No player may "star" more than once. When four are playing the first and second out are allowed to "star" if they choose, and the last two remaining players should divide the pool, unless a previous arrangement to play out has been arrived at before the game commenced.

This game perhaps affords more amusement when played by separate players rather than by couples forming sides and acting together against an opposing couple. When played separately, it is quite allowable, in the event of one player getting far ahead or into a much better position than the remaining players, for the remaining players to concentrate their opposition against the one who is ahead, and by that means to prolong the game, and keep the chances more even and open

to the end. On the other hand, the player in the best position will look more to playing so as to block the second player than those farther behind, as it will be evident that most has to be feared from the nearest competitor. Combinations against a player must not be ostentatiously made by open agreement, but as a matter of course and on principle. When playing with others ignorant of the necessity of acting in opposition when occasion arises, a player had better then attend to his own hand only, and do the best he can with it. Silence in playing the game should be strictly observed, and no hint whatever may be given by one player as to the cards held to any other player, but each one should, by watching the play, judge what cards are held by each.

The *Whist* game is a capital domino game; it seems to be but little practised, but there really seems no reason why it should not rival the real game of whist, after which it takes its name. It is played, like whist, by four players, two on each side, the partners sitting opposite to each other. The whole of the twenty-eight dominoes should be shuffled and dealt while their faces are still turned downwards, seven to each player. The cards should be shuffled and dealt by each player alternately, every player being entitled, if he claims it, to shuffle the cards before they are dealt. The dealer is entitled to the lead. The play goes round alternately after the lead has been made, and it is the duty of each player to so watch the game as to be able to baffle his adversaries and help his partner. Watching the game is much more useful in this than in any of the preceding domino games, inasmuch as all the twenty-eight cards being out there is no necessity to calculate upon the chances of such and such cards remaining in reserve. It is best to play as much as possible those cards of which several bearing the same number are in the player's hand, and also to get rid as soon as possible of those cards bearing high numbers. A good memory is needed to play the game properly, as it is a great advantage to remember by whom every card played was *posed*. The manner of scoring the game may be arranged to suit the fancy of the players; but the simplest, and perhaps the best, will be found to be one modified, according to the differences in the games, upon that described in scoring *Domino Pool*.

The game of *All Fives*, or *Muggins*, is very popular in some circles; it makes good practice in quick counting, and is comparatively much more dependent for success upon the skill than upon the luck of the player. Two, three, or four players may at one time take part in the game, and each player takes an equal number of dominoes, always providing that at least two dominoes remain untaken, and that no player has more than seven cards. The dominoes must, of course, be shuffled and distributed with their faces downwards. The object of the players is to make the opposite end pieces, when added together, count five or some multiple of five. All double dominoes must be placed transversely. This, although usual in all games of dominoes, is not generally compulsory; but in the game of *All Fives* and the kindred games it is absolutely necessary, for reasons that will be apparent when the mode of counting is described. Every five or multiple of five made, upon a domino being *posed*, by adding the end number of the *posed* domino to the number shown at the opposite end of the row, scores one. Each player should alternately lead first in commencing a game, and should be careful to keep well in mind the numbers of all the cards held, so that every chance of making a five or its multiple may be taken. The game may be fixed at any reasonable number; but thirty-one in this game makes it about equal in length to the other games described, if the scoring there recommended is the scoring adopted. The following description of play will show how the game proceeds and how the counting is managed:—

Thus the first player puts down, say, a double five and scores two. This card is, of course, the very best to hold and to play first with, as it secures a score

and is an effectual block to the next player scoring unless he plays the five blank. The next card played we will imagine to be a five-six, which shows a result at the two ends of sixteen, viz., a six and a double five. The next card played being a five-four at the double five end will give the player a score of two, and will show, by combining the cards at the two ends, ten pips, made up of the six of the six-five card and the four of the five-four card. So on the play proceeds, during which it will become apparent that four is the highest score that can be made at any one *pose*, which would be made up of the double six (twelve) at one end and the double four (eight) at the other, being twenty pips in all. Every player should play on, so far as possible, until all the cards not in reserve are played. A scoring card must be called when *posed*, or the score is lost.

All Threes is a version of *All Fives*, and is similarly played, except that three or its multiple scores in the place of five and its multiple. The chances of scoring being more frequent than in the preceding game, it requires perhaps even more attention on the part of the players. The score should run up to fifty instead of stopping at thirty-one, as in the game of *All Fives*. The scoring numbers in this game are three, six, nine, twelve, fifteen, and eighteen pips, which score respectively one, two, three, four, five, and six. The three pips may be made up from a double one at one end and a one at the other, by a two at one end and a one at the other, or by a three at one end and a blank at the other. The highest score of six comes from a combination of eighteen pips, and is made up of the double six at one end and a six at the other, or by a double six and a double three at the opposite ends.

In the games of *All Fives* and *All Threes*, the pips of those cards that cannot be played are sometimes added together, and the number of fives or threes, as the case may be, contained in the aggregate number of pips is added to the score of that player who holds the smallest number of pips, or, when any player has played out, to the score of him who first played out.

The Fortress, or *Sebastopol*, is an ordinary block game, simplified by dividing out all the pieces and having no reserve. Four players are needed for the game, and the lead falls to the possessor of the double six. The second and third players must both play to the six or the follow passes. The object of the game is twofold: firstly, to win, and secondly, to form an irregular fortress or bastion of the dominoes, by placing them fantastically, either following on in line the previously placed dominoes, or placing future dominoes after the first three are placed at either of the corners of the domino to which they are proper, according to the choice or fancy of the player.

The hints and directions given in the domino games already described are generally applicable to this game.

The Four Game is also a very simple game, and is, as its name indicates, also intended for four players. As in the game of *the Fortress*, so in this, all the dominoes are dealt out, seven to each player, the lead or first *pose* and the subsequent order of the players being decided in some such method as that set forth for the *Block* game. The first player, and each succeeding player as his turn comes round, has the right to play out as far as possible, and it not unfrequently happens that all the seven cards may, if judiciously arranged, be placed at one *pose*. At any rate, the cards should always be so worked as to enable a player to *pose* as great a number of cards as possible every time the turn to *pose* comes round to him. The scoring recommended in the *Block* game may be applied to this game.

Tiddle-a-wink, or *Tidley Wink*, is an amusing domino game adapted for a round party, which proceeds after the manner set forth in the ordinary following games adapted to the conditions here given; —

The number of dominoes given out to each player must be regulated by the number of players: if six are playing, four cards may be allotted to each; if more than six, three cards only should be given out to each. Eight is the largest number that can conveniently play with the ordinary pack that ranges up to the double six only, but with the more numerous packs the number of players may, of course, be increased. When the dominoes have been distributed, the double six, or the highest domino of the pack used, is called for, and to the holder of that domino belongs the lead, the players subsequently playing in turn round from the first player's left hand in proper order, according to the arrangement of the seats. Should the double six not be answered to, the double five is called, and so on, until the highest double not in the reserve has been ascertained and placed. In this game the player of a double, whether it be at the commencement of the game or afterwards, has the privilege of playing a second domino at once, without waiting for his next turn. With these modifications the game is similar to the *Block* and *Draw* games. The player first out cries "Tiddle-a-wink," and wins the game. If the game is blocked, no player running out, the holder of the dominoes showing the smallest aggregate number of pips wins.

It will now be seen that the various games of dominoes combine in themselves, more or less, both skill and chance. Of course, nothing avails against an overpoweringly strong hand, but the combinations of most of the games are so various as to give ample scope for the exercise of ingenuity.

It may be mentioned that substitutes for dominoes may be readily made by an ingenious lad. It will be useful to note this, as a set of dominoes is not always obtainable at a moment's notice, and it is not unreasonable to expect that duplicate sets may sometimes be found serviceable. Moreover, boys, and grown people also, set more store upon those things that they may have made or prepared for themselves than upon those that are merely bought or received as presents. For this purpose, those cards supplied by printers and stationers called "third large cards" will be found available without cutting, requiring only to be marked with the proper number of pips.

Gambling with dominoes is an utterly bad practice, which every parent will stringently put down, and which no manly boy will indulge in; as gambling with cards has brought all card games more or less into disrepute in many families, it is to be hoped that any gambling with dominoes, and consequent discrediting of this innocent game, will be firmly discountenanced. Those games of dominoes that more readily offer gambling facilities have been purposely omitted from this book. *Domino Pool* need not necessarily be played with money at all; a few nuts, or marbles, or the ordinary counters may be made to do duty in the pool.

FOX AND GEESSE.

The game of Fox and Geese is a good game of skill for two players about equally matched. There are many ways of playing it, but those best known and most adopted are two. One game is playable on an ordinary draught-board with four geese and one fox; the other is playable on a solitaire-board with either fifteen or seventeen geese and one fox. Plain boards or cards marked after the manner of a draught-board or a solitaire-board, according to the game played, may be utilised in the place of those boards.

The object of the players in both games is identical, viz., the player of the geese tries to block the fox in a corner, and the player of the fox to take from the board as many of the geese as possible, or to elude their pursuit.

The game on the draught-board (Fig. 1) is played in the following manner:—The geese are placed on the four squares of the same colour that appear on the side of the board next to the player who plays the geese, and the fox is placed by

its player on any other one of the squares on the board that is of the same colour as those selected by the player of the geese. The arrangement as shown in the diagram is the one usually selected. The only drawback to the game played in this way is the certainty that if the geese are manipulated by a player who understands the game the fox cannot elude their pursuit. The moves are made as at draughts, diagonally, the geese being able to move forward only, like the ordinary draughtsmen, while the fox has the power of moving both backwards and forwards, as the kings in Draughts. There is no taking of pieces in this version of the game. The geese are entitled to the first move, after which each player moves alternately. So long as the geese keep as much as possible in a straight line, making their forward movements at that point on the board farthest from that at which the fox is stationed, the fox will not be able to break through; but this will need careful play and much practice before the whole secret will be thoroughly mastered. On the other hand, the fox must be ready to take immediate advantage of the first opportunity to slip through the rank of his foes, as one chance missed, he has no right to expect another.

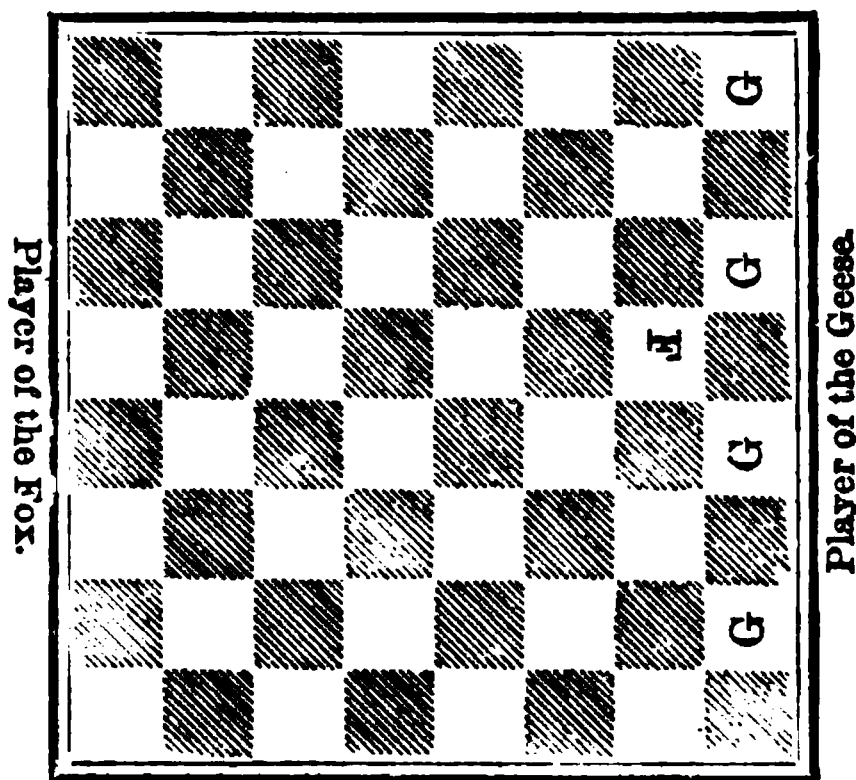


Fig. 1.—FOX AND GEESE PLAYED ON A DRAUGHT BOARD.

The arrangement of the men for the game when played on the solitaire-board is shown in Fig. 2. The game should be played with the marbles supplied with the solitaire-board, the geese being all of one colour, but a different coloured marble being selected to do duty for the fox. In starting the game, the

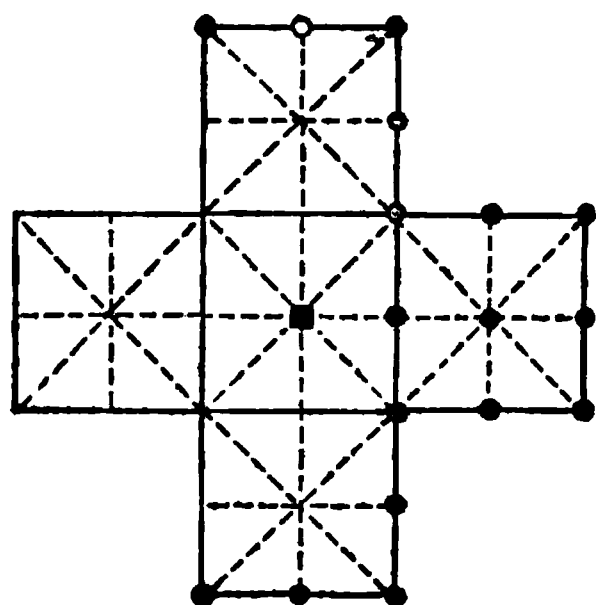


Fig. 2.—FOX AND GEESE PLAYED ON A SOLITAIRE BOARD.

fox is to be placed, as shown, in the middle of the board, the geese being also placed at the commencement as indicated by the plan. The players are more equally placed in this than in the preceding game, although the advantage, all other things being equal, is still with the player of the geese. As in the previous games, the fox only has the right to move either backwards or forwards; and in this game he may also move sideways, a privilege likewise granted to the geese, which are limited to the forward and side-long movements only. When a goose is standing on any spot adjoining that on which the fox stands, there remaining in a straight line immediately behind the goose a vacant spot, the fox, in his turn, is allowed to move over the goose, and, as in draughts, take it. If the fox omits to take a goose when he has the chance, he is "huffed," and the player of the geese is entitled to the return of one of his pieces, if he have lost any, or to the return of the first piece he may lose. Pieces so returned are to be placed immediately in the rear or alongside of the last row of the geese. The fox wins if he succeeds in breaking through the ranks of the geese, and the geese win if they

succeed in blocking the fox so that he cannot move. The player of the geese is sure to win if he only carefully keeps all the forward pieces near to the position of the fox, covered both on the rear and also on that side away from the fox. The fox should avoid as much as possible being driven into the square of the board behind him. The geese are always entitled to first move.

On many solitaire-boards diagonal lines are drawn, but they are not to be made use of by the geese, and only by the fox when an agreement to that effect is made in commencing the game. The fox's chances are by that means increased very considerably. The best authorities never allow the use of the diagonal lines in playing Fox and Geese. Inexperienced players frequently allow the use of the diagonal lines to the players, both of the fox and the geese.

The boards used for playing "Nine Men's Morris" are sometimes utilised for the game of "Fox and Geese." The principles of the second game here described are applicable to the game when played on the "Morris" board.

GO BANG.

Go Bang, like so many of our games, is a Japanese game of great antiquity. Its introduction to modern civilisation is due to Mr. Cremer, Junior, to whom the present generation of youngsters is indebted for many of the more modern games, and for the various new adaptations of the old games. At the time of its introduction to England Go Bang was recommended by its sponsor both as a winter and summer pastime, and was described as "intellectually as exhilarating as Chess, and in its method very superior to Draughts;" "as an especial favourite amongst the aristocratic classes of Japan, and deservedly so, for while there is no game the scheme of which is simpler, considerable tact is requisite for the successful playing of it."

The following are given as the rules of the game, it being premised that "Go Bang" is intended to be played by two or four persons:—

1. The game is played on a flat board, divided into squares similar to a Chess-board. There are four hundred squares in all, twenty on each side.
2. To each of two players are allotted two hundred pieces of distinctive colours, or to each of four players one hundred pieces.
3. The players alternately set down a piece in any one of the unoccupied squares on any part of the board.
4. The game is won as soon as any one of the players can get five of his men together in a straight or in a diagonal line.

The following is another version of the Japanese game of Go Bang:—The players, who may be two or more, being provided with a number of pieces, which are equally divided in distinctive colours for each player, determine who shall commence the game. The players then proceed to play alternately, by placing their pieces on squares marked on a board, each player endeavouring so to place the pieces allotted to him that they may surround one of his opponent's pieces. Upon this being accomplished, the piece so surrounded is taken from the board by the player who has so surrounded it. The game is won by the player who at the time the whole of the men are exhausted has taken most of his opponent's pieces.

There is still another version of Go Bang (adapted, no doubt, from the previously described games) which is very much played in some districts, but which the present writer has never yet seen described in any book of instructions. It is more applicable to the materials that may be expected to be readily come at in any ordinary household than the somewhat elaborate board of four hundred squares and the four hundred pieces mentioned above. The game will be found very simple in principle, and will in practice call forth considerable skill and ingenuity.

The version of the game referred to is played by two players only, with two sets of twelve draughtsmen distinctively coloured, and the board used for the game is simply the ordinary draught-board.

Each player alternately places one of the draughtsmen on any vacant square on the board that he may choose, until each player has placed all his twelve pieces. If during the placing of the pieces either player succeeds in getting five of the pieces together in a vertical, horizontal, or diagonal line, he wins the game. But this rarely happens when both players are fairly well skilled in the game. Upon both sets of pieces being duly placed on the board, each player alternately moves one of the pieces to any square adjoining vertically, horizontally, or diagonally, but to only one square at a time. The object of the players is still to get a line of five pieces together in any one direction; and so soon as this is done, the player first making and calling attention to such a line by saying "Go Bang" wins the game.

A square piece of white cardboard, ruled with sixty-four squares, and two sets of twelve differently-coloured counters, or small bits of card, are the only really needful materials for the game.

Those of our readers who have played draughts *ad nauseam* with their friends until their individual and peculiar moves are familiar, are recommended to try a game of Go Bang, as described above, and the writer will vouch for it that the smallest praise the game will receive will be that "it is a nice change after draughts."

GOOSE.

The game of Goose (or, as it is generally called, "The Royal Game of Goose") is of German origin, where it is still played and known as the "Post and Journey Game." It is almost identical with the game known as the Race Game and its adaptations. To play it in the truly orthodox manner, the figure of a goose divided into sixty-three divisions should be printed or marked upon a sheet of paper; but a numbered draught-board, or any other piece of paper marked with the required number of properly-distinguished partitions, will be found to answer the purpose equally well. The goal of the journey should be decided to be the partition or division numbered 63. Any number of players may join in the game, each one of whom should be provided with some distinctively-marked figure or counter, to denote on the board or goose his position in the game. A pair of dice and a box are to be provided, and the players one after the other, according to the order decided upon, throw with the dice, and place or move their respective counters according to the numbers they throw. For example: in the first throw if, say, ten be thrown on the two dice, the player throwing that number places his counter on the tenth square, or at subsequent throws, were the same number to turn up, would move his counter ten squares forward. The player who first lands his counter at the sixty-third square wins the game; but be it observed, the exact number of sixty-three must be made—neither more nor less. If more than sixty-three be thrown, the player has to count the excess number backwards, which considerably delays a forward player, and diminishes what would otherwise be a good chance of success. For example: some player having landed at, say, the sixty-first square, wants but two to win, and when his turn to throw the dice comes round, he throws, say, two sixes, or twelve pips, with the result of counting two forward into the sixty-third square, and ten backward into the fifty-third; and so on, until the number landing some lucky player in No. 63 is thrown.

There are many ways in which the game may be varied, and among others are the following:—The figure of a goose may be placed at certain intervals in

some of the compartments, and an arrangement made that any player throwing into a compartment so marked should be allowed to score double the number shown by the dice. Obstacles to a rapid advance are also sometimes introduced, such as bridges, inns, ponds, prisons, and the like. At the bridges players are usually fined one or more counters, and allowed at once to proceed; at the inns players are made to stay during one or more rounds of throws of the dice, paying meanwhile to the pool a certain number of counters for their rest and accommodation; at the ponds players are thrown back to the spot from which they started at that round, or, as a change, are made to stay in the pond until some other player, throwing into the same number, effects the release by helping the previous unfortunate traveller out of his difficulty; in the prisons also they are made to stay until some other player lands himself in the same predicament, when the first prisoner is released, leaving the releasing player in gaol until he again is liberated by some other unfortunate getting into the like difficulty. The aids to advancement or the hindrances may be modified according to the ingenuity and wish of the players.

LOTO.

Loto is a popular round game for children. It is played with cards, on which are inscribed, in the manner shown in the diagram, numbers ranging from 1 to 90—five numbers on one row. The units are arranged in the first column, the tens in the second, the twenties in the third, and so on. The number of the cards supplied with the game varies, but it is generally not less than eighteen; and it will be apparent, therefore, every number should then appear on the complete set three times. There are also supplied with the game ninety wooden nobs or discs, also numbered from 1 to 90, and a quantity of glass or bone counters. At the commencement of the game a dealer has to be chosen, who shuffles the cards, and gives one to each player, or an equal number of cards to each player, the dealer himself standing out. The dealer then, having placed the numbered discs into a bag, draws them forth quickly one by one, calling out the numbers as he does so. The player having the corresponding number on his card who first answers to a number called covers the number on the card with one of the glass counters, which should be so placed on the table as to be available for the use of all the players. That player who first succeeds in covering all the numbers on his card or cards wins the game.

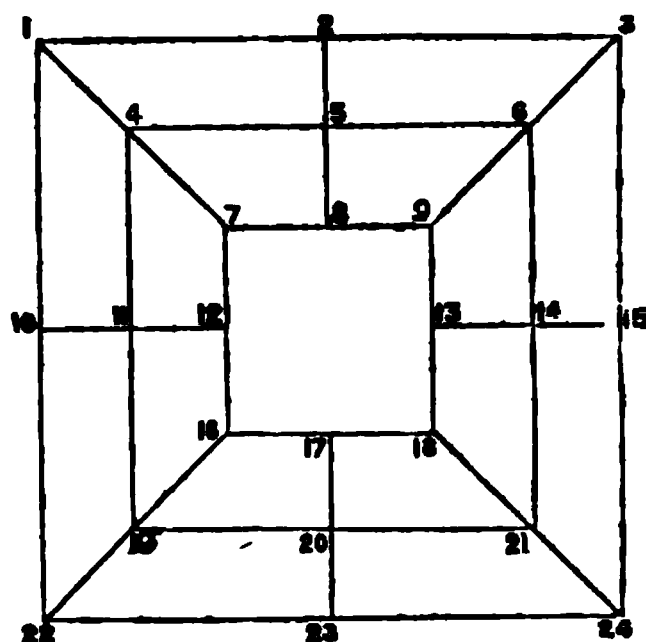
Loto is usually played for a pool made up by equal contributions of nuts or counters from each of the players; it is then customary for the player who first succeeds in covering one row, rather than one card, of numbers to take one-fourth of the pool, two rows covered giving another fourth, and the remainder (the half) being retained for that player who first gets a whole card filled.

There are many varieties of the game of Loto, with pictures, flowers, letters, &c., instead of numbers, which are known as Picture Loto, Botanical Loto, Spelling Loto, Historical Loto, Geographical Loto, and so on. They are all played in exactly the same manner as the Numbered Loto.

In England, Loto is regarded as a game only for the amusement of young children; but in America, under the name of "Kenô," it is played in various places of public resort by adults for considerable stakes, and is esteemed capital practice in reading numbers rapidly and correctly.

NINE MEN'S MORRIS.

Except in a few old-fashioned nooks and corners of England, this is now an obsolete game. It is, however, one of the oldest of English games, and is well worth resuscitation; it is referred to by contemporary writers as commonly played during the fourteenth century, and Shakspeare introduces its name into the "Midsummer Night's Dream" in such a way as to show clearly that it was much practised in his time. Now, as then, where the game is at all known, it is played out of doors on a diagram marked on the ground, or on the tables of the village ale-shops. Recently, however, enterprising toy firms have adapted the game to in-door recreation, but they have not yet at all agreed upon the description or the rules of the game. The board on which the game may be played is easily made—a slate, a piece of cardboard or wood being all that is necessary; the men or pieces can also be arranged out of stones, wooden chips, or any other convenient object. To make the board, three squares should be drawn one within the other, as shown in the accompanying plan. For convenience, it is well that the sides of the inside square should be not less than four inches in length, and that between each square there should be at least one inch of blank space, that amount of space being left on the board outside the outer square. Cross lines connecting the three squares should be made, as shown in the diagram. The lines joining the angles of the squares are frequently dispensed with, especially by the more experienced players, and in the references following do not count as lines. The game is for two players only, each player being provided with nine men, distinctively marked or coloured; draughtsmen, counters, chessmen, or even stones and bits of wood will do, provided only that any one piece of the one set of nine is readily distinguished from any one piece of the opposing set. When the game is played out of doors on the soft ground, small stakes with the bark peeled, and with the bark on respectively, make most convenient men, as they can easily be stuck in the ground at the required spots.



NINE MEN'S MORRIS BOARD.

The first to play having been decided, each player alternately places one of his men at any one of the spots or corners, marked with figures in the diagram, which is not previously occupied by any other piece, the object of each player being to get three of his men on one of the rows numbered

1 2 3; 4 5 6; 7 8 9; 10 11 12; 13 14 15; 16 17 18; 19 20 21; 22 23 24;
1 10 22; 4 11 19; 7 12 16; 2 5 8; 17 20 23; 9 13 18; 6 14 21; or 3 15 24.

As previously pointed out, the lines joining the angles, and that are respectively numbered

1 4 7; 3 6 9; 16 19 22; and 18 21 24

should not count. When any player succeeds in this, he is at liberty to remove one of his antagonist's men, subject to the regulations specified farther on. After all the pieces have been laid, the game proceeds by the players alternately moving some one of their pieces along the lines to some unoccupied spot, the object being, as before, to get three men placed in one line.

The above description, with the following directions, hints, and maxims, should

be sufficient to enable any two lads hard up for toys, and wanting a game, whether in-doors or out of doors, the materials of which can be made to hand, to find in "Nine Men's Morris" that amusement and recreation of which they are in search; and they will discover, if they only improvise the materials for themselves, and so become for the time independent of the toy-shop, that their enjoyment of the game will be none the less. On the turf in the shade, on a hot summer's day, or in-doors on a wet day, the game may be equally enjoyed, and made available for whiling away pleasantly a spare hour or half-hour.

When a row of pieces is formed by any one player, he is entitled, as already mentioned, to pound or remove one of his opponent's pieces; but this privilege is not to be enforced by breaking a formed line, so long as pieces not making a formed line are on the board. Some rules give it that a line must never be broken by removing a piece, but it does not appear that this is at all a general prohibition. Other rules, again, have it that a line formed does not count unless made after all the pieces are down, and that a row made in placing the pieces must be opened and made again before it can be allowed to count. The rules of the game generally supplied are almost unanimous in giving it that the game is won by a player capturing all his adversary's pieces, or by so blocking them that they cannot be moved. It is, according to some rules, lawful to take pieces if one player can pass over an adversary's piece to a vacant spot beyond—as, for example, if a white piece stood on the spot No. 3, a black piece on the spot No. 15, the spot No. 24 being vacant, and it at the same time being the turn of the player using the white pieces to move, he would be allowed to jump over from 3 to 24, and to remove the black piece at the spot 15. The game played under all these variations is equally good, and it is only necessary that from the description here given players should be able to decide upon those regulations that they agree to be bound by, in order that no dispute may arise during the progress of the game.

In the truly rustic mode of playing the game, a system of what is termed "hopping" is allowed when either party is reduced to three men. When so reduced, a player, instead of being compelled to move his pieces, as above explained, along the lines from one spot to another, is allowed to take up a piece and place it at any spot on the board that may be vacant; and when "hopping" is allowed, the game is ended when one player is reduced to two men—as, indeed, it must always be, two pieces being insufficient to form a line, the player so reduced necessarily losing the game.

It is a good plan for a player to endeavour to secure what is termed a see-saw, which is done by opening one row, and making another with the piece so removed. A good see-saw will soon result in winning the game, unless the adversary is equally fortunate or is able soon to break it up. Thus, if a player has a row at the spots 2 5 8, and two balls, one in 15 and another in 24, the spot 3 being empty, by moving from 2 to 3 another row with 15 and 24 is made, and *vice versa*, alternately moving backward and forward, and making a row with each move.

With the following hints as to what constitutes good play, we will leave our readers to develop for themselves a game at Nine Men's Morris:—Avoid crowding one's own pieces on any one square or squares; place them pretty evenly on all three squares. Obtain the corners of the squares as much as possible. Block the adversary's pieces whenever possible. In placing the men, look more to securing good positions than to obtaining rows at that early stage of the game—of course, always taking the necessary precautions to prevent the opposite side from obtaining a row. Never lose an opportunity of a see-saw, as already explained. When "hopping" is permitted, have your own pieces well placed to make successive rows before reducing your antagonist to the fatal three.

SOLITAIRE.

The game of solitaire, which by name must be familiar to almost all, is of ancient date, and its origin has been attributed to many circumstances. Among other anecdotes told to account for its invention, it has been stated that the principle of the game was first thought of and worked out by a prisoner in solitary confinement in the Bastille, who played at the game with such materials as he could arrange to relieve the monotony of his imprisonment. This story is as good and as likely to be true as any other; suffice it only to remark that it is a game that invariably exercises a great fascination over all who try to solve its problems. The more ancient boards are marked with thirty-seven holes, but these are now rarely to be seen, the boards with thirty-three holes being almost invariably used. The arrangement of the holes on the different boards is shown by the accompanying arrangement of figures and letters :—

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C1	D1	E1					
C2	D2	E2					
A1	B1	C3	D3	E3	F1	G1	
A2	B2	C4	D4	E4	F2	G2	
A3	B3	C5	D5	E5	F3	G3	
C6	D6	E6					
C7	D7	E7					

Arrangement of the modern Solitaire
Board of 33 holes.

Small glass marbles or balls being placed in every hole, the object of the game is usually to clear the board of every ball but one, and to leave that ball in the hole first made vacant. The manner of attaining the desired object is to be done by first lifting a marble off the board, and afterwards by lifting one marble over another into a vacant space immediately beyond, removing the marbles from the board as they are passed over. The game played on the old-fashioned board is very much more difficult than that played on the modern board; and although there are many ways in which all the pieces but one may be removed, it is believed to be impossible to so remove them, according to the rules of the game, as to leave the last marble in that hole from which the first was taken.

It is almost useless giving the key to any of the games played with the older-fashioned board; but in case such a board may be in the possession of any of the readers of this book, a few of the problems that can be worked out are here noted; or if it is desired, the necessary plan of the holes can be made on a slate or piece of cardboard, and small discs of wood be substituted for the orthodox glass balls or marbles supplied at the toy-shops with the ordinary boards.

Problem No. 1.—Leave space No. 1 vacant, and the last ball can be left at No. 15, at No. 22, or at No. 35.

Problem No. 2.—Leave space No. 26 vacant, and the last ball can be left at No. 28, or No. 36.

Problem No. 3.—Leave space No. 3 vacant, and the last ball can be left at No. 37.

"	"	4.—	"	19	"	"	"	"	6.
"	"	5.—	"	32	"	"	"	"	2.
"	"	6.—	"	37	"	"	"	"	3.

It will also be found that these problems can be solved in several different ways.

We will now proceed to give the keys in full of the problems that may be

worked on the modern board of thirty-three holes, in order to show the principles that have to be observed in removing the different pieces—principles that can be more forcibly brought home by practising the problems with the key than by working them out by merely written descriptions. Carefully notice the arrangement of the letters and figures in the second plan, and observe that each column of holes is numbered consecutively from top to bottom, the long columns from 1 to 7, and the short columns from 1 to 3. Notice, further, that each column is distinguished from every other column by a distinctive letter, A to G. The plan made will be used in describing all the problems.

Problem No. 1 is known as the Centre Hole game, and consists in removing the centre marble and leaving the last marble on the board in the centre hole. The following is the key:—

- Remove D4.
1. Pass D2 into D4 and remove D3.
 2. " F1 " D3 " E3.
 3. " E1 " E3 " E2.
 4. " E1 " E2 " E3.
 5. " C1 " E1, and again on into E3, removing D1 and E2.
 6. " E6 " E4 and remove E5.
 7. " G3 " E5 " F3.
 8. " D5 " F3 " E5.
 9. " G1 " G3, and again on into E5, removing G2 and F3.
 10. " B3 " D5 and remove C5.
 11. " C7 " C5 " C6.
 12. " C4 " C6 " C5.
 13. " E7 " C7, and again on into C5, removing D7 and C6.
 14. " C2 " C4 and remove C3.
 15. " A1 " C3 " B1.
 16. " D3 " B1 " A1.
 17. " A3 " A1, and again on into C3, removing A2 and B1.
 18. " D5 " D3, and again on into B1, B3, D5, and F3, removing D4, C3, B2, C5, and E5.
 19. Pass F2 into D4 and remove E4.
 20. " C4 " E4 " D4.
 21. " E3 " E5 " E4.
 22. " F3 " D5 " E5.
 23. " D6 " D4, the point of starting, and remove D5.

Problem No. 2.—Remove the ball at A2 and leave the last ball in that hole.

1. Pass C1 into A2 and remove B2.
2. " C2 " C4 " C3.
3. " D4 " B2 " C4.
4. " E2 " C2 " D2.
5. " D6 " D4, and again on into D2, removing D5 and D3.
6. " D1 " D3 and remove D2.
7. " E4 " E2 " E3.
8. " E1 " E3 " E2.
9. " G2 " E4, and again on into E2, removing F2 and E3.
10. " G1 " E3 and remove F1.
11. " E2 " E4 " E3.
12. " F3 " D5 " E5.
13. " E7 " E5 " E6.
14. " D5 " F3 " E5.
15. " G3 " E5 " F3.
16. " C7 " E7 " D7.
17. " E4 " E6 " E5.
18. " E7 " E5 " E6.
19. " B3 " D5 " C5.
20. " E5 " C5 " D5.
21. " A1 " C3 " B1.
22. " D3 " B1 " C3.
23. " C1 " C3 " C2.
24. " C6 " C4, and again on into C2, removing C5 and C3.
25. " A3 " A1, and again on into C3, removing A2 and B1.
26. " C2 " C4, and again on the point of starting at A2, removing C3 and E2.

Problem No. 2 may be repeated by removing the middle ball of the outside short row on each of the other three sides of the board, viz., D1, G2, and D7, the method followed to clear the board being adapted from the above key.

Problem No. 3.—Remove the ball from D3.

1. Pass F1 into D3, and remove E3.
2. " F3 " F1 " F2.
3. " G1 " E3 " F1.
4. " G3 " G1 " G2.
5. " D3 " F1 " E3.
6. " G1 " E3 " F1.
7. " D5 " F3 " E5.
8. " E7 " E5 " E6.
9. " F3 " D5 " E5.
10. " C5 " E5 " D5.
11. " D7 " D5 " D6.
12. " C7 " C5 " C6.
13. " C4 " C6 " C5.
14. " A3 " C5 " B3.
15. " C2 " C4 " C3.
16. " A1 " C3 " B1.
17. " C4 " C2 " C3.
18. " C1 " C3 " C2.
19. " C6 " C4, and again on into C2, removing C5 and C3.
20. " A2 " C4, and remove E2.
21. " E5 " C5, and again on into C3, removing D5 and C4.
22. " E3 " E5, and remove E4.
23. " C2 " C4 " C3.
24. " D1 " D3 " D2.
25. " E1 " E3 " E2.
26. " D3 " F1 " E3.
27. " C4 " E4 " D4.
28. " E5 " E3 " E4.
29. " F1 to the point of starting at D3 and remove E3.

This problem may be varied, and the key adapted accordingly, by removing the balls from the holes E4, D5, and C4.

Problem No. 4.—Remove the ball D6.

For the sake of brevity the keys to the remaining problems will give the changes only, it being always remembered that those pieces passed over in the changes are to be removed from the board.

1. Pass D4 into D6.
2. " F3 " D5.
3. " E7 " E5.
4. " C7 " E7.
5. " E4 " E6.
6. " E7 " E5.
7. " E2 " E4.
8. " G1 " E3.
9. " C3 " G1.
10. " D3 " F1.
11. " G1 " E3.
12. " B1 " D3.
13. " C1 " C3.
14. " E1 " C1.
15. " C4 " C2.
16. " C1 " C3.

17. Pass C6 into C4.
18. " A3 " C5.
19. " A1 " A3.
20. " D5 " B3.
21. " A3 " C5.
22. " C4 " C6.
23. " C6 " E6.
24. " E4 " E2.
25. " E2 " C2.
26. " C2 " C4.
27. " E6 " E4.
28. " B2 " D4.
29. " D3 " D4.
30. " F2 " D4.

And 31. D4 into D6, from which the problem was started.

This key, again, may be adapted by removing F2, D2, and B2.

Problem No. 5.—Remove the ball C1.

1. Pass C3 into C1.
2. " A1 " C3.
3. " D3 " B1.
4. " A3 " A1.
5. " A1 " C3.
6. " B3 " B1.
7. " B1 " D3.
8. " E2 " C2.
9. " C1 " C3.
10. " E4 " E2.
11. " E1 " E3.
12. " G2 " E4.
13. " E4 " E2.
14. " E6 " E4.
15. " G3 " E5.
16. " D6 " F3.

17. Pass C6 into E6.
18. " E7 " E5.
19. " E4 " E6.
20. " C7 " E7.
21. " E7 " E5.
22. " F3 " D5.
23. " C4 " E4.
24. " C5 " E5.
25. " E5 " E3.
26. " E2 " E4.
27. " G1 " E3.
28. " E4 " E2.
29. " C3 " E3.
30. " E3 " E1.

And 31. E1 into C1, the hole from which the first ball was taken.

This problem may be adapted and made applicable when any other one of the seven corner balls is removed.

Problem No. 6.—Remove the ball c2. The same plan can be adopted if the ball be removed from c6, e2, e6, b1, b3, f1, or f3, the key being adapted accordingly.

1. Pass c1 into c2.
2. " c1 " c3.
3. " a2 " c4.
4. " c4 " c2.
5. " e1 " c1.
6. " c1 " c3.
7. " e2 " c2.
8. " c2 " c4.
9. " a1 " c3.
10. " e4 " e2.
11. " g1 " e3.
12. " e2 " e4.
13. " f3 " f1.
14. " g3 " g1.
15. " g1 " e3.
16. " d5 " f3.

17. Pass e7 into e5.
18. " f3 " d5.
19. " c6 " e6.
20. " c7 " e7.
21. " e7 " e5.
22. " c4 " c6.
23. " e4 " c4.
24. " c3 " c5.
25. " c6 " c1.
26. " e5 " c5.
27. " c4 " c6.
28. " a3 " c5.
29. " c6 " c4.
30. " f3 " c3.

And 31. c4 into c2, the hole from which the first ball was taken.

Problem No. 7.—Remove the ball c5. Corresponding play would follow if either c3, e3, or e5 were removed instead.

1. Pass e5 into c5.
2. " e3 " e5.
3. " d3 " d5.
4. " e6 " e4.
5. " c5 " e5.
6. " e4 " e6.
7. " c3 " c5.
8. " g1 " e3.
9. " e2 " e4.
10. " g3 " g1.
11. " f3 " f1.
12. " g1 " e3.
13. " e4 " e2.
14. " c1 " c3.
15. " b1 " d3.
16. " e1 " c1.

17. Pass e2 into c2.
18. " c1 " c3.
19. " d3 " b1.
20. " b3 " d5.
21. " b1 " b3.
22. " a3 " c5.
23. " a1 " a3.
24. " d6 " b3.
25. " a3 " c5.
26. " c6 " c4.
27. " e6 " c6.
28. " c7 " c5.
29. " c4 " c6.
30. " e7 " c7.

And 31. c7 into c5, the hole from which the marble was first taken.

If the above problems and their variations have been carefully studied it will be seen that they, with their variations, give the necessary keys by which a ball may be taken from any one point on the board; and, following the rule of the game, every other ball but one can be removed, the last ball being left in the hole from which the first one was taken. The other problems that relate to leaving a given number of balls more than one in certain specified positions are almost innumerable; but it is not necessary to give their solutions here. If those given are thoroughly mastered any desired combination may be easily effected.

The following statement will show which of the above problems is to be used when any particular ball has been removed :—

Problem No. 1 gives the solution when the centre hole "d4" has been removed.

" " 2 when a2, d1, d7, or g2 has been removed.

" " 3 " c1, d3, d5, or e4 " "

" " 4 " b2, d2, d6, or f2 " "

" " 5 " c1, or any of the other seven corner balls has been removed.

" " 6 " b1, b3, c2, c6, e2, e6, f1, or f3 has been removed.

" " 7 " c3, c5, e3, or e5

RECREATIVE SCIENCE.

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INTRODUCTION.

ON the village green some dozens of youngsters are busily playing at cricket. They have wickets, bat, and ball of only an indifferent sort, and the ground they have to put up with is more like a collection of mole-hills than what we usually regard as a cricket-field. It is, however, plain to be seen that they take note of none of these things, and enjoy themselves with batting, balling, and fielding as much as the ducks enjoy their splashing and swimming in the pond close by.

About a mile off you may see the well-appointed field of maturer players. The ground has been rolled flat with such care that it is questionable whether one could detect an unevenness on its surface, even with a spirit level. At one corner of the field a wooden hut has been erected and daintily painted, and inside this our players disrobe and put on cricketing suits of the most approved pattern and colour. Their bats and their balls are of the very best, and they play with zeal, but we venture to assert that they enjoy the game of cricket not a bit more than the youngsters on the village green. Even so, we believe, is it in scientific pursuits when employed as recreation. The daily growing army of men and boys who make science of some sort their hobby proceed in very different ways to gratify it. The men, especially the professionals, go in for most elaborate apparatus; but the boys, true to the instinct displayed on the village green, make the best of everything they can lay hold of. It will be our object in these pages to help the latter wherever possible, so that they may make experiments with home-made apparatus at very little cost, and, what is, perhaps, better still, gain an insight into phenomena such as never could be obtained by reading alone. We will first, then, say a few words, by way of introduction, about the organs we use for making mental note of what is passing before us.

THE FIVE GATEWAYS OF KNOWLEDGE.

We can all see, hear, taste, smell, and feel, and by these means we have been for ages increasing our stock of knowledge. Good John Bunyan, in one of his pleasant books, compares the body to an ancient city, which, after the manner of all ancient cities, has gates for the incoming and outgoing of its inhabitants. This marvellous city, which each of us possesses, has five gates, which are the gateways of knowledge. They are: the eye to see with, the ear to hear with, the nose to smell with, the tongue to taste with, and the skin to feel with. As we have just said, it is by their means that, for a long time, we have been increasing our stock of knowledge, and becoming more acquainted with the wondrous things in us and around us. And we have become so accustomed to the accuracy of the information we obtain by them, that something very extraordinary indeed must happen when a man can scarcely believe his own senses. Our senses, however, may be deceived, as we shall now try to show.

AN AMUSING EXPERIMENT, WHICH SHOWS HOW THE EAR MAY BE DECEIVED.

Get a companion to seat himself in a chair, say in the presence of a numerous company. Blindfold him. Now grasp a couple of pennies between the finger

and thumb of the right hand, and insert the first finger of the left hand between them, so that when this finger is withdrawn a clicking noise will be heard. What we have to show is that our blindfolded companion cannot tell where this clicking noise comes from when the pennies are in certain positions. If the click is made on either side of the head, he will guess rightly the position of the pennies; but if the noise be made with the pennies anywhere in an imaginary plane which cuts the head into two symmetrical halves—that is, in a plane which passes through the crown of the head downwards midway between the ears and in the other direction straight between the eyes, bisecting the nose and chin—then he cannot tell whereabouts the clicking pennies are. If you make the click under his chin, he will probably guess that it is behind his head, with other misguesses equally as laughable. As everybody believes he can do what his neighbours cannot, there will be several anxious to see whether they cannot guess rightly.

They must be properly blindfolded in turn, so that if the experiment be tried in gaslight they will have no idea as to the position of the hands holding the pennies. If the experiment be well performed, they will all blunder alike, to the no small amusement of the good folk present. It may be that after three or four have tried the game, some knowing one present, intently studying their mistakes, may have learnt approximately what allowance to make in guessing at the position of the clicking pennies. If you want to keep up the fun, have nothing to do with him.

This experiment was first shown at the Belfast Meeting of the British Association, in 1874, by Professor A. Cruik Brown (Fig. 1).

Fig. 1.—PROFESSOR
CRUIK BROWN'S
EXPERIMENT.

The ear, then, may plainly be deceived by any sound emanating from a point in the medial plane which we have described. And this will enable you to explain a natural fact which you may often have observed. It is a bright day, say, in June. In rambling through the green fields, we hear no sound save that of the mower whetting his scythe or the lowing of the kine not far off. Before long we are attracted by the song of a lark. We try in vain to find out where the bird may be, for probably the first turn of the head has brought it into the medial plane, so that we may look for a long time in the direction we fancy the song comes from, and we shall not discover the lark. By turning the head a little, however, we remove the bird's position from the medial plane, and the chances now are that we shall look in the proper direction for it, and find it.

LIGHT APPEARING WHERE THERE IS NONE.

Shut your eyes, and with one finger pressing the eyeball between the eye and nose, work it upwards and downwards. A round whitish kind of light is perceived opposite the point of the finger, which in form has not inaptly been compared to the "eye" in a peacock's tail. There is no extraneous light to produce this figure, whence it would appear that pressure on the eye alone will produce the sensation of a light. A violent blow in the neighbourhood of the eyes is generally accompanied by "dancing sparks."

TOUCH DECEIVED.

Blindfold a young companion; the younger he is the better, that is if he can count. Now cross the first and second fingers of one of his hands, and tell him

to pass them over the marbles you have in your hand. You have only one marble or taw in the palm of your hand, but he will in the majority of cases declare that you have two. He exhibits some hesitancy if you now bring the crossed fingers to his nose, for while he feels that he has two noses, he *knows* that he has only one.

THE EYE DECEIVED AGAIN: HOW I SAW A BLUE MOON.

It is pretty evident, therefore, from these simple examples that the senses cannot always be depended upon, and the longer we live the more forcibly we see it. Especially is this the case when we have made science our hobby, for the habit of observation that has become a part of us is constantly detecting things which are opposed to our common experience, due in very many instances to one or other of our five senses either failing or deceiving us. Here is an instance. One morning in mid-winter the inhabitants of a manufacturing village were startled into wakefulness by the dreadful sound of an American "buzzer," or steam whistle. It was the village fire-alarm. Anon, to the shriek of the whistle were added the noise of the tramp of hundreds of footsteps, and the hum of their voices as they hurried towards the scene of the disaster. Tardy risers that morning saw all the buildings lit up by a reddish light, as when illuminated by the red rays of the setting sun, and upon rushing forth they beheld one of the largest cotton mills in that quarter a mass of wild red flames, savagely devouring the flooring, bursting the windows, licking the stone walls, and stretching their scorching tongues far across the street. It was beyond all saving, therefore there was nothing for it but to stand and gaze at so grand and unusual a spectacle. And now the moon came forth from behind a cloud, as if anxious to have a sight. *Her face was blue!* "Surely there is something wrong with my eyesight," I loudly exclaim, and there and then appeal to some half-dozen bystanders, asking each one the colour of the moon. "Blue," they all reply. Although none of us ever heard of a blue moon before, there it was, and there was no denying its existence; but upon second thoughts it seemed probable that the singularity lay in our eyes, and not on the surface of the moon. What we all now saw was but a modification of an experiment well known to physiologists. Let a bright red wafer be stuck upon a sheet of white paper, and steadily looked at for some time with one eye; when the eye is turned aside to the white paper a greenish spot will appear. These two colours, red and green, are said to be complementary, because each has what the other wants to make it white. Whenever the eye gazes for some time at a bright colour, when the gaze is removed to a white ground, we appear to see the complementary colour. Here then we people were gazing steadfastly for half an hour at the yellowish red light of the blazing pile, and it was quite to be expected that when we transferred our gaze from the fire to the moon the latter should seem to be of a colour complementary to that of the fire—in other words, blue. And so it was; while to a person just coming fresh upon the scene the moon appeared of its usual silvery lustre.

WHAT THE SENSES UNDECEIVED HAVE TAUGHT US.

Now, with the senses we have ascertained all manner of things, every material fact, indeed, that we know. We have besides constructed helps in the way of telescopes, microscopes, microphones, telephones, and so on, by means of which our senses have been, so to speak, intensified, so that we have been able to penetrate a little farther into those regions of the unknown by which we are hemmed in on every side. When deceptions such as we have spoken of have arisen, proper allowance has been made for them, and they have been investigated.

Consequently, a vast amount of knowledge has been amassed and classified, and such portions of it as come under the heads of sound, light, heat, electricity, magnetism, chemistry, mechanics, and practical geology, we propose to deal with in an elementary and experimental way in the following short chapters.

SOUND.

SUPPOSE yourself in a dream state for a single day, with every sense asleep except that of hearing, so that for seventeen hours or more you are in nothing but a world of sounds. Betimes in the morning you are assailed by the loud note of the chanticleer, apparently anxious to waken all its neighbours, or by the grave caw of the rook in bird-talk with other members of the rook community. The discontented twitter of quarrelling sparrows you also hear, and then, after a time, come all the sounds which accompany man's labour: the bells and whistles intended to waken him up, closely followed by the sound and noise of production and traffic; so that the day's concert may be fairly said to open with the bell-like notes of the anvil and the snort of the "iron horse." The labourers are now at full swing; they have warmed to their work, and all their sounds and noises are merged into one loud hum, from which you may, now and again, single out some constituent, and the hum continues throughout the day, save when, for an hour or so, there is a pause for the sensitive portion of the vast machinery to take fuel in the shape of food and to take rest. At last the day's work is over. The hum has ceased, and now your ears are assailed by the laugh and the chat of the craftsman, grateful that his task for one day more is finished. The ringers have met in the belfry, and send forth a merry peal; while from the usual meeting-place of the village musicians there steals forth many a piece of harmony, made sweeter by the scraps of discord which in practising precede and succeed it. Ere long all is quiet once more; the streets are deserted, and the last sounds which greet your attentive ears are the notes of the curfew-bell.

Such a day's experience shows us very clearly the importance of sound—how great a part it forms of one portion of our existence; and it would therefore be a matter of much interest the ascertaining what sound really is. One of the facts we earliest become acquainted with is that whatever produces in us the sensation of sound or noise enters the ears, so that when we have been desirous of not hearing any speech we have stopped our ears, or if we have wanted to shut out the noise of a cannon we have done the same. And you may remember reading that when Ulysses wished to prevent his companions from being lured to destruction by the sweet and ravishing music of the Sirens, he stuffed the ears of his followers with wax. The best, then, and the most general explanation one could give of the ring of a bell would be that *something* comes from the bell, enters the ears, and produces the sensation of sound. We have to ascertain what this something is, and before we begin to suppose anything at all about it, it will be best to find out some of its peculiarities.

SOUND TAKES TIME TO TRAVEL.

If you ever watched cricketers playing when you have been about half a mile away from them, you cannot have failed to observe that when the batsman has driven the ball far away from him, you have seen the ball leave the bat a couple of seconds, roughly speaking, before the noise of the knock has reached you.

If you have at any time stood observing the riflemen practising at a distant range, you cannot have failed to notice that first you have seen the flash and

smoke of a gun, and not until a second or two after, according to your distance, have you heard the report of the explosion. If very far away, and the atmosphere has been unfavourable, you may not have heard the gun at all, although you saw the flash and the smoke. This, you know, was the case with Crusoe, who, after having escaped from his Moorish captivity with Xury, tried to attract the attention of a Portuguese ship by letting off his gun. The Portuguese heard no report, but they saw the fire and the smoke.

Yet again, you may often see an artisan give a blow with his hammer when you are a long way off. You take note when the blow is delivered, and the sound you hear distinctly after it, and separated by an interval of time. These results of common experience teach us unmistakably that sound, in passing through air, *takes time* to travel, and this is something to think over, as one might, if his attention were not called to the fact, suppose that as soon as ever a sound is produced it is heard at the same moment, wherever it can reach; such a supposition would be a wrong one.

SOUND IS NOT PRODUCED IN AN EMPTY SPACE.

We have next to ascertain whether air, or any other substance, is necessary for a sound to pass from the sounding body to the ear of the observer. That the passage of sound is affected by various states of the atmosphere is pretty well known to ordinary observers, but what would happen supposing we were to reach the top of one of the loftiest mountains? Would our voices sound as loud there as at the surface of the sea? and would the report of a pistol be as deafening? Travellers tell us that even at moderate heights the voice ceases to be heard, and that on the top of Mont Blanc a pistol sounds no louder than a cracker; hence one can imagine that right away from the earth, where the air has scarcely any existence, no sound can be produced at all—that there, in the words of Tennyson, “sound of human sorrow never mounts.”

A very rare atmosphere can be produced artificially, by means of which it may be shown that air is necessary for the production of sound, because, if a bell or some other sounding body, as, *e.g.*, a musical box, be placed inside this very rare atmosphere, you hear no sound proceeding from the bell or box. This is a common lecture experiment. A bell-jar fits air-tightly on to a flat circular plate, and in the middle of the plate there is a hole leading to an air-pump, *i.e.*, a pump which will draw air from within the bell-jar, just as an ordinary pump draws water out of a well (Fig. 2). A bell is placed under the jar, and then the pump is set working. If this bell be capable of ringing itself, say, by clockwork or some electrical arrangement, it will be found that the more air we get out of the bell-jar the weaker the sound becomes, until at last, if we could empty the glass bell-jar altogether of air, no sound at all would be produced. May it not therefore be that sound begins with a disturbance of the air, and that air afterwards propagates this disturbance, and that finally we become aware of sound when the ear is reached by the disturbed air? This explanation was given more than five hundred years ago, for Geoffrey Chaucer tells us that he supposes the origin and propagation of sound to be like the origin and propagation of water-ripples. He was right in some respects, and we cannot do better than compare the two

Fig. 2.—BELL UNDER BELL-JAR.

phenomena. When you throw a stone into water you disturb it; ripples spread out from the centre of disturbance, and a leaf lying on the surface of the water some distance from where the stone was thrown in will rise and fall as each



Fig. 3.—BELL SOUNDING WITH BOB OF PENDULUM AGAINST IT.

ripple passes it. Now try this experiment: Take a paper bag, and pucker up its mouth into a small round hole. Through this blow the bag tight, and close its puckered-up mouth with the hand. If you now bring down the fist smartly on to the distended bag, it will burst with a loud noise. What happened? The air within the bag was very much compressed, and when set free by the bursting of the bag, the air disturbance spread in every direction not unlike the water-ripples, and as the leaf before rose and fell when one of these ripples passed it, so now the drums of our ears rise and fall as this air-disturbance passes them, producing in us the sense of a noise. And generally we may say that whenever a body is sounding it is disturbing the air

around it, and that the disturbance is being passed on from air-particle to air-particle, until at last some of the motion is taken up by the drums of our ears.

KICKS FROM VIBRATING BODIES.

To return, then, to our bell. One would think that if, when sounding, it will agitate air-particles, it might possibly agitate heavier bodies, and thus give a proof to the eye that it is moving rapidly, although invisibly, to us. We will see whether it is so. Roll a little bit of wax into a ball; fasten one end of a piece of thread to it, and fix the other end to a horizontal stand of some sort. Now, when this pendulous bit of wax is quite at a standstill allow it to just come in contact with a small bell that is sounding on the table. The vibration of the bell cannot be seen, but that it is vibrating is very plain, for it kicks the small bit of wax right away from it instantly it is touched (Fig. 3).

When our wax pendulum is at rest, strike one of the prongs of a tuning-fork so as to cause it to sound out, and while it is sounding bring it gently against the suspended wax ball. The ball flies away again.

SOUND-WRITING.

That a tuning-fork, when sounding, has each of its prongs moving rapidly or vibrating, although invisibly, may be shown in another very interesting way, a way which furnishes us with perhaps the simplest of all examples of sound-writing. Our writing tablet here has to be a smoked glass. Therefore take a sheet of glass and hold it over the candle flame. Move it backwards and forwards until it is uniformly smoked all over with a fair coating of soot. We now require a style to write with, and we must place it somewhere so that it will write the sound of the tuning-fork. To this end drop a small bit of wax upon the edge and at the end of one prong of our tuning-fork. Now for a style. Snip off one end of a needle by means of a pair of pliers. Take this bit of needle and thrust the point into the melted wax on the tuning-fork. When the fork sounds now the iron style vibrates to and fro with the prong it is on. It vibrates too quickly to be



Fig. 4.—SOUND-WRITING.

seen, and here comes in the use of our smoked glass. While the fork is not sounding draw the style smartly through the coating of soot; a straight line is produced. If the style were vibrating to and fro across the direction of this line, then, instead of being straight, there ought to be a sort of "in and out" line produced when the style is rapidly drawn through the smoke. We will try and see whether it be so or not. Give the fork a good knock so as to set it sounding. And now, while it is sounding, draw the style smartly over the smoked surface of the glass. Instead of a straight line (a) we now get a sinuous or wavy line (b), showing us clearly that the prong of the fork is moving rapidly when it gives out sound (Fig. 4).



Fig. 5.—SOUND OUT OF A WINE-GLASS.

Here, then, we have two proofs that a tuning-fork, when sounding, is rapping away at the air on its sides, and while we are dealing with this portion of our subject we may as well show how sound originates in some other bodies.

EXPERIMENTS WITH A DRINKING-GLASS AND OTHER ARTICLES.

We may perform a couple of interesting experiments with a drinking-glass. The vessel must be of thin glass, or one of these experiments will be difficult, if

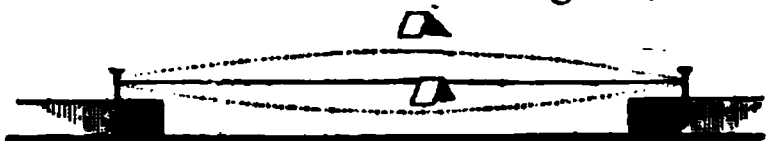


Fig. 6.—A VIBRATING STRING FLINGING AWAY A RIDER OF PAPER.

not impossible to do, whereas if thin it may be readily done. Tap the glass, and you will set it sounding just as one makes a tuning-fork sound, and you will observe the sort of note it gives out. Now for the second experiment. Fill the glass nearly to the top with water, and having wetted the border, draw the end of the big finger of one hand along it with a gentle pressure (Fig. 5). A clear note will be emitted, and by continued rubbing around this upper edge of the glass you will increase the sound, and see at the same time a strange commotion of the water within it. Minute globules in thousands are being sent from its surface, and especially from the sides, where they are kicked away with wonderful rapidity, showing us that the glass, while sounding, is vibrating.

When a stretched string, fast at both ends, is either plucked as in the harp, or bowed as on a fiddle, sounds are emitted, and we may here see the vibration of the string in some cases; but if we want to be more certain about it we have nothing to do but put a small rider of paper on a horizontal string of this kind, when it will dance up and down as long as the string vibrates (Fig. 6). But strings may be made to emit sounds without plucking as in the following instrument, with which boys are sometimes, we are afraid, too much in the habit of trying to annoy their neighbours. A small tin canister, with one end knocked out, has a little hole punctured in the opposite end just large enough for a piece of twine to be passed through, and pulled until a knot at one end within the canister will not permit of the twine passing any farther (Fig. 7). Now if the canister be grasped with the left hand, and the right hold a piece of well-rosined leather, it will be found that when the string is grasped by the leather, and the leather is slid along it, a very great noise is produced. When a number of these instruments are

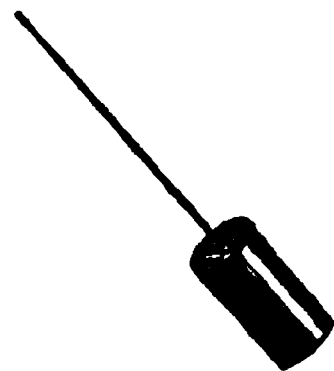


Fig. 7.—NOISE INCREASED BY A CANISTER CAVITY.

working together they resemble nothing so much as an army of clucking hens, and the name of "devil's fiddles" has therefore not inappropriately been given to them. The remarkable fact about this instrument is the use of the canister, which undoubtedly acts as an increaser of the sound. The use of such a cavity may be again shown in the following experiment:—Take

a band-box, and having removed the lid, pierce the bottom fair in the centre, so that a piece of twine, say four feet long, may be passed through and tied with a knot, just as in the case of the canister. Upon now grasping the free end of the twine, and swinging the band-box round and round so as to describe a circle, the funniest of sounds will be emitted. It will be seen farther on that the cavities of the ears sometimes increase sound in a similar manner.

DISTINCTION BETWEEN NOISE AND SOUND.

We have now learnt sufficient to understand the distinction between musical sound and noise, which is this:—When a musical sound is pro-

duced, the sides of the sounding body strike the air very rapidly—say, for example, two hundred times a second; while when a noise is made the air is knocked, as it were once, and that violently, as when we burst an air-tight paper bag, fire a gun, or pass an electric spark through air (p. 506).

Fig. 8.—A SIREN.

THE SIREN.

A rapid succession of puffs of air will produce a musical note as well as the repeated taps against it of the prongs of a tuning-fork or the sides of a bell. An instrument for exhibiting this experiment may readily be made (Fig. 8). Procure a circular sheet of tin about eight inches in diameter, and let equidistant holes be punched into it, say an inch from the edge, and concentric with it. The disc of tin must now be attached to a whirling table, which is a device for making anything revolve very rapidly, and consists of two pulleys—a large one which is turned by a handle, and a smaller one which is turned by being connected by a cord to the other. One revolution of the large pulley produces several revolutions of the small one, and it is to the axis of the latter that the perforated disc of tin is firmly attached. If now you place one end (*c*) of a piece of indiarubber tubing on to the nozzle of some bellows, or in the mouth, and fix a glass jet at the other end (*p*, Fig. 8), you may direct a pretty continuous stream of air on to the holes, while a comrade rapidly rotates the disc. Suppose you have forty

Fig. 9.—MORE PERFECT SIREN.

holes in the tin disc, and that it revolves ten times in one second; then it is evident that the sound which it produces results from $10 \times 40 = 400$ puffs of air, and 400 vibrations per second of a tuning-fork would emit the same note. The instrument we have described is called the siren, and Fig. 9 illustrates the make of a more complete instrument. All we need call attention to here is that in

Fig. 10.—SAVART'S WHEEL.

this finished instrument we have the number of puffs registered by a specially constructed recording part, the fingers of which are seen at the top of the siren. With our own rough apparatus we should make out that the kind of note produced depends upon the number of puffs, the highest note obtainable resulting from the greatest number of puffs, and lower notes being produced by a less number of puffs per second. The same fact is taught us by Savart's wheel, which consists of a toothed or cog wheel (*a*), and a driving wheel (*c*). Each of the teeth of *a* catch against a card (*b*), and produce at a moderate speed much the same effect as one of those rattles that children now play with, and which were sprung by watchmen in olden times when they wanted to raise an alarm. Now, suppose that by means of the handle the driving-wheel is turned around rapidly, a distinct note will be emitted, and the ear will no longer be able to recognise the separate taps of which it is made up. (Fig. 10.)

CATHEDRAL BELLS EXPERIMENT.

Do you want to hear big, heavy bells within your own room? Then nothing is so simple as the device that may be employed for the purpose. Take about three feet of twine, and tie a loop in the middle in this fashion (Fig. 11). Fix the loop now round the knob end of a poker, and draw it tight. Grasp the free ends of the twine next with the two hands, and having twirled some of it around the end of the first finger of each hand, close the ears with these fingers, and bring the swinging poker smartly against the wall. Deep ponderous tones will be heard, quite as impressive as those of Big Ben when he shakes the Clock Tower of St. Stephen's with his sound. But no one else in the room is similarly impressed with the sound, until they take hold of the ends of the twine and try the experiment in like manner. It would appear, then, that the sound being conducted along the string is increased somehow. Is it not a very strange thing, however, that this increase is heard, although we have closed the ears, because closing the ears, as we all know, generally keeps sound out? Upon examining the conditions of the phenomenon closely, they appear to have some likeness to those which we utilised in the "devil's



Fig. 11.—
A LOOP
IN TWINE

fiddle" for imitating the clucking of a hen, as there is a cavity with a string attached to it by means of the finger. It seems, therefore, that this ear-cavity increases the sound coming from the poker by means of the string, just as before the canister cavity increased the sound produced on the string attached to it.

WHEATSTONE'S MICROPHONE.

The microphone of Sir Charles Wheatstone was constructed on this principle, and we need hardly add that it is not to be confounded with the instrument invented by Professor Hughes, described on page 423. Wheatstone's microphone consists of two flat pieces of metal (*a* and *b*), each sufficiently large to cover the external ear (Fig. 12). On the outside of each plate, directly opposite to the ear-passage, there is riveted a rod of iron or brass wire, about sixteen inches in length, and one-eighth of an inch in diameter. The two rods are fastened together at their unfixed extremities, so as to meet in a single point (*c*). The rods have to be so curved that when the plates are applied to the ears each rod

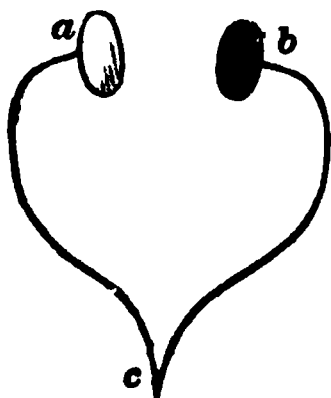


Fig. 12. — WHEATSTONE'S MICROPHONE.

may at one end be perpendicularly inserted into its plate, and at the other end may meet before the head in the medial plane (p. 404.) The spring of the rods will be sufficient to keep the plates fixed to the ears. Wheatstone gives the following experiments which may be readily tried with his microphone. When a bell is rung in a vessel of water, and the point of the microphone is placed in the water at different distances from the bell, the differences of loudness are very sensible. When the point of the microphone is applied to the sides of a vessel containing a boiling liquid, the various sounds which are produced may be very distinctly heard. If the stem of a sounding tuning-fork be brought in contact with any part of the microphone, and at the same time a musical sound be given out by the voice, one will be able to perceive the "beats" produced when the two sounds are very nearly, but not exactly, alike.

HOW SOUND TRAVELS.

A little while ago we likened the passage of an air-disturbance or noise to the passage of a water-disturbance or wave (p. 407). If you study the water-wave, however, a little more closely, you will find that the drops of water have only an up-and-down motion, for if you place a cork in the path of the wave it will simply rise and fall, i.e., the water particles which support it rise and fall. The wave passes and the cork remains nearly where it was. Hence this wave of water is only a travelling form, and the water particles simply rise and fall, and receive and communicate this up-and-down motion from and to their neighbours. The motion of the water particles is at right angles to the direction the water-wave takes. It is in this last particular that a sound-wave differs most markedly from the water-wave. When the prongs of a tuning-fork are vibrating, each knock a prong gives the air is succeeded by a withdrawal of the prong preparatory to giving another knock. The first knock then gives the air particles a push, a number of them are crowded together, and the motion being communicated from one particle to another, this crowded state, or "condensation," travels along just as the crest of a water-wave travels. But after this push the prong flies back, and now, instead of a crowded state of air particles, there is produced a thin state, or state of rarefaction, and this rarefaction likewise travels along like the hollow of a water-wave. Then comes another crowding, another thinning, and so on,

with a rapidity that would be invisible even if the air particles were as big as taws. The motion of any individual air particle during this transmission of the tuning-fork's motion is a to-and-fro movement, a backward and forward motion, so that in the transmission of a sound-wave the air particles move in the same plane and in the same direction as that in which the sound travels. The length of a water-wave is reckoned from crest to crest, or from hollow to hollow; in the same way the length of a sound-wave is reckoned from condensation to condensation, or from rarefaction to rarefaction.

HOW TO ASCERTAIN THE LENGTH OF A SOUND-WAVE.

Now whatever may be the various kinds of sounds, we know that they all travel with the same speed, for you may stand a long way from any kind of band, and if you can hear the music you perceive no discord arising from some notes being slower or faster than others in travelling from the band to yourself, whence it follows that all travel with the same speed. But the siren and the Savart's wheel prove unmistakably that different notes are originated by different numbers of puffs or taps; in other words, that while one note is originated by a great number of condensations and rarefactions, another is formed by only a comparatively small number. It is, therefore, plain that different notes have different wave-lengths. Let us suppose, then, that sound travels in air at the rate of 1,000 feet per second, in round numbers (the more particular figures we shall give farther on), and that the Savart's wheel is giving out a note produced by 200 taps on the card per second; it is pretty evident that in the space of 1,000 feet there will be 200 condensations and 200 rarefactions, and, therefore, 200 waves. If, therefore, there be 200 waves in 1,000 feet, each wave must be five feet long.

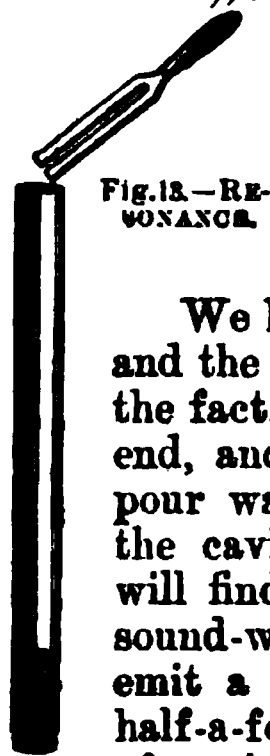


Fig. 13.—RESONANCE.

HOW SOUNDS MAY BE REINFORCED.

We have already learnt that cavities may increase the loudness of sound, and the following simple experiment you may take as an additional proof of the fact. Take a long jar, or a long tube, that has been corked up at one end, and hold a sounding tuning-fork over its mouth (Fig. 13). If you pour water into the jar you will find that there is a particular length of the cavity where you get the greatest effect. Measure the length. You will find that the length of the tube is one-fourth the length of one of the sound-waves originated by the fork. If, for example, the fork were to emit a note of two feet wave-length, then the resonating tube would be half-a-foot long. Hence you will perceive the use of having pipes in organs of various lengths, for they act precisely like this glass tube we have been using, and (in emitting their fundamental notes) may range in length from a couple of inches to thirty-two feet, giving us all the variety of sound originating from waves four inches to sixty-four feet long.

Suppose, now, we were to reduce the length of tube or of the resonating cavity, by pouring water into it. At a length of three inches it would not respond for the old note, but the octave sound, i.e., the sound produced with half the first note's wave-length, would now be heard. And you might go on shortening the tube according to a definite rule, and certain sounds would be produced which one might predict. This is a fact, which enabled Sir Charles Wheatstone to explain the science of the Jew's-harp.

PHILOSOPHY OF THE JEW'S-HARP.

The Jew's-harp is an instrument that boys are particularly fond of twanging

but the music that is generally got out of it is not nice, to say the least of it, and it is only now and again that some lad, more clever than his fellows, can make it discourse sweet music. It consists of an elastic steel tongue, riveted at one end to a frame of brass or iron, the form of which is represented in Fig. 14. The free extremity of the tongue is bent outwards to a right angle, so as to allow the finger to strike it easily when the instrument is placed to the mouth, and firmly supported by the pressure of the parallel extremities of the frame against the

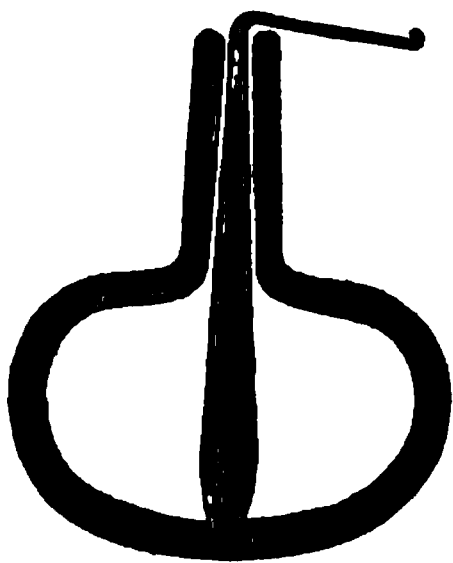


Fig. 14.—JEW'S HARP.

teeth. Now, when a performer strikes the tongue of a Jew's-harp, he sets it vibrating, and giving out sound just in the same way as a tuning-fork, and its sound would be increased if we were to place near to it empty jars of different lengths. The celebrated Wheatstone made this experiment. He fixed a Jew's-harp firmly at the two points where ordinarily it rests against the teeth, allowing sufficient space between the two supports for the tongue of the harp to vibrate freely to its greatest extent. The free extremity was then weighted with wax until it sounded the note C, which corresponds to the sound of a closed tube four feet in length. He now brought before the tongue of the instrument the open end of a closed tube two feet long, and so furnished with a movable piston that the length of the column of air

within the tube could be altered at pleasure, and he found in this way that he could produce any note he wanted.

It would appear, then, that the mouth acts the part of a closed tube or cavity when one plays a Jew's-harp, and if the mouth of the performer possesses the requisite degree of cunning, it will alter its form and dimensions according to the kind of note the performer wishes to send out.

REFLECTION OF SOUND: ECHOES.

Whenever a sound is produced, no matter how, any number of observers in different positions all hear it; the sound, in short, spreads out in all directions. But as each observer receives only a small portion of this sound—just so much of the air-disturbance, in fact, as can enter his ears—it will considerably simplify matters for us if we consider only that portion of the air-disturbance which reaches us. Let us, then, try and explain the following curious fact, to start with:—A band of music is marching along a street in the direction of the arrow at A (Fig. 15). In one of the houses which line the street (B) an observer (o) sits listening to the approaching band, and is firmly impressed with the idea that it is coming in the direction of the dotted line o A', i.e. just in the contrary direction! Now when you are out in the open air, you are so accustomed to looking towards where a sound is produced, if you want to know where it is, that you will instantly say a source of sound is *where it appears* to come from. We have seen, however, how we may be deceived in this respect (p. 404) when our eyes are bandaged, and in the present case we have an instance of how we may be deceived

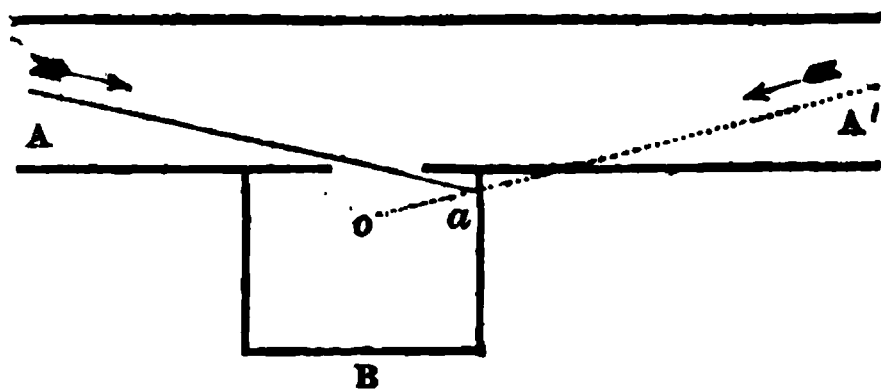


Fig. 15.—HOW A BAND OF MUSIC COMING ALONG THE STREET MAY APPEAR TO BE COMING IN THE OPPOSITE DIRECTION.

with our eyes open. The music from the band proceeds in the direction Aa , through the window, and is sent back, or, in scientific language, is reflected, from the wall at a , in the direction ao , towards the observer. And, as we have said, the observer being accustomed to think that a sound has its origin somewhere in the direction whence it appears to come, the observer at o thinks the band is on the opposite side of the house from where it is, and the illusion is not dispelled until the band has come very near indeed. You have, perhaps, noticed the same kind of thing out in the open air. While a distant band has been played

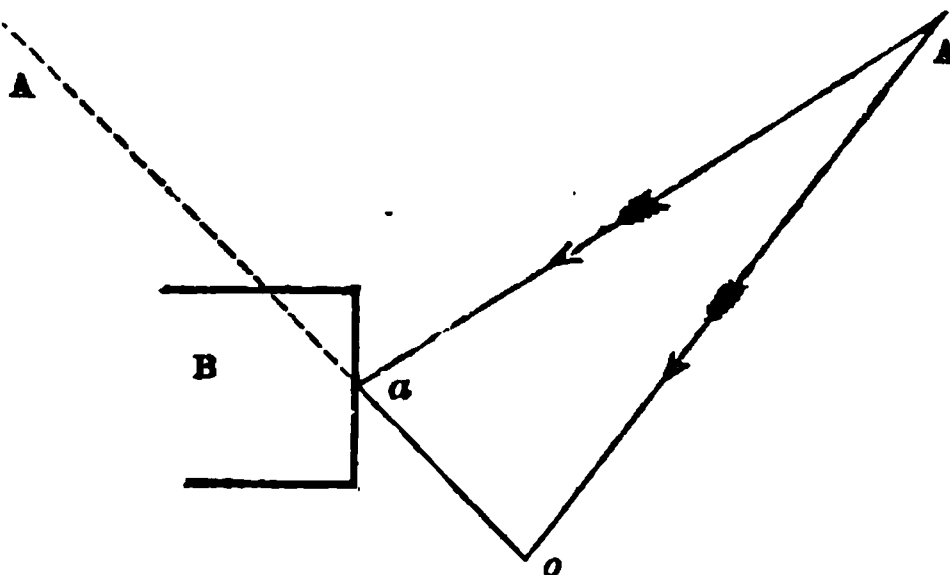


Fig. 16.—ANOTHER FORM OF DECEPTION ARISING FROM REFLECTION OF SOUND.

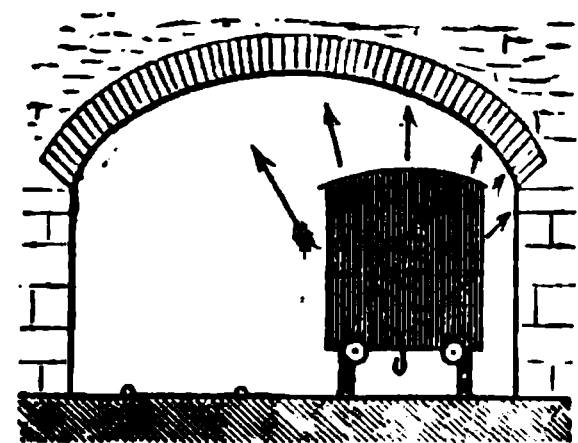


Fig. 17.—THE DIN IN A RAILWAY TUNNEL.

at A , you have, perhaps, been walking towards the end of a block of buildings at B . Suddenly the music, instead of appearing to come in the direction Ao , has seemed to come in the direction ao . This is a case of reflection of sound, precisely similar to the preceding one, only perhaps not so surprising, because more evident. Precisely the same kind of thing gives rise to echoes. We have already seen that sound takes time to travel, and we may add, that it has a speed in air of about 1,125 feet per second. Now let us suppose that the distances Aa and Ao , in Fig. 16, are both alike, and that the distance ao is 1,125 feet. What will happen when a shot is fired at A ? The air-disturbance, travelling in all directions, will reach a and o at the same instant, because they are the same distance off A ; and at this

instant the observer at o will hear the report. Just a second after he will hear a second report, fainter than the first, and coming in the direction ao . This is the echo. Now it will be perceived that, in the first example (Fig. 15), ao is only a distance of a few feet, and when the band was heard in the open air, ao (Fig. 15) was at most only a few yards, so that the original sound would coincide with the echo, and not be heard so well as we have shown would be the case were ao 1,125 feet long.

We have in every-day life a curious instance of the reflection of sound presented to us in the unbearable din one hears in passing through a railway tunnel (Fig. 17). The rattle of the carriage in a hundred parts passes away when you are proceeding over a line of railway in the open country, but when you get into a tunnel, every noise coming against the archway is reflected back just to where you are sitting; and it is in this focus of noises that you have to stay until you get out into the daylight once more. In

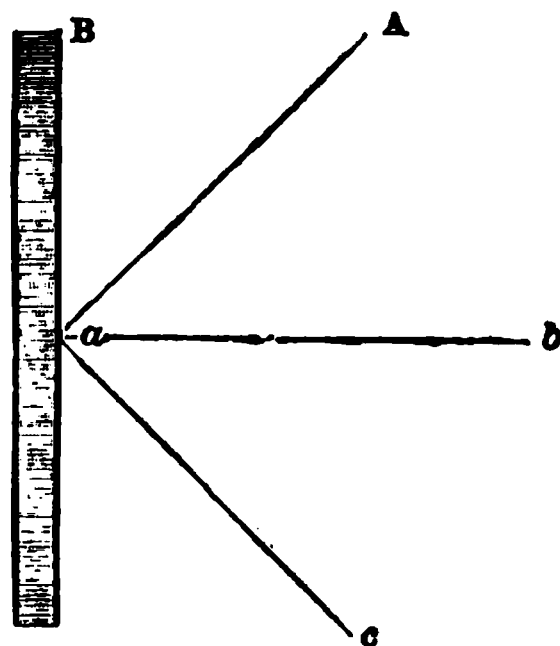


Fig. 18.—A LAW OF REFLECTION OF SOUND.

the tunnel the original noises and their echoes may be said to coincide, the distance between the carriage and the top of the arch being so small.

We may now point out that if the direction of a sound coming against a plane surface, such as a wall or side of a house, be known, one can tell what direction it will take in passing from it. Suppose, for example (Fig. 18), we have in *A* a source of sound, and that a portion of it impinges on the wall *B*, at *a*, taking the direction *A a*, then we know exactly what direction the reflected sound will take. From the point *a* draw the line *a b*, at right angles to the surface of *B*. The sound we are considering will, in passing from *a*, proceed so that its line of direction will make an angle with *a c* equal to the angle *A a b*. Hence it will proceed in the direction *a c*. It thus happens that if we are acquainted with the nature of the surface we can tell in what direction all reflected sounds will go when we know where the sounds are produced. By strict reasoning from the foregoing proposition, we know that if we have (Fig. 19) a concave mirror (*r*) forming portion of a sphere, whose centre is *c*, all sounds proceeding from a point midway between the mirror and *c*—that is, from *w*—will be reflected in the direction of the arrows; so that if another similar mirror be placed seven or eight yards away, the sound

Fig. 19.—REFLECTION OF SOUND BY HOME-MADE REFLECTORS.

will be again reflected from it, to a point (*e*) where it may be heard. Here are the practical instructions for making the experiment. We require two concave reflectors, and they may be had for a few pence. Instruct the tinman to beat you out two circular sheets of tin, about fourteen inches in diameter; and he must beat them into a concave form, such as he employs for his can bottoms. If he does this very carefully, you will be in possession of two good reflectors of sound. Out of two oblong blocks of thick wood a convenient stand for each reflector may be made by driving into each block a piece of stout iron wire, and then getting the tinker either to solder them to the convex backs of the reflectors, or else to solder a bit of tin tube on to each of their backs, so that the upright shafts of iron may be easily inserted. When finished, they will present somewhat the same appearance as the two reflectors (*r* and *r*²) represented in Fig. 19. Now hang a watch from a support of some sort—it matters not what, so long as the support stands on one side of the reflector—and opposite to the watch place the reflector (*r*), with its concave or hollow face turned towards the watch. The latter must be on a level with the centre of the reflector, and a foot or more away from it, just as it may be found necessary. Take the second reflector (*r*²) about seven yards away, and present its hollow face towards that of the first reflector (*r*); they must be so placed with regard to each other that one straight line joins the centres of the watch (*w*) and the two reflectors. If *r*² be now turned

slightly round on its iron support, an ear placed at *s* will hear the ticking of the watch most distinctly; and if it be removed a few inches above or below *s*, the ticking is no longer heard. Now, this is a very interesting experiment in the reflection of sound, and must be done to be appreciated.

SPEED OF SOUND.

We have given 1,125 feet per second as the speed of sound in air; it varies, however, with the temperature, for sound travels faster in warm than in cold air. The same holds good for the velocity of sound in other bodies. Thus, according to Wertheim, the speed of sound in the water of the Seine was 4,714 feet per second at 15° C.; while at 60° C. it had increased to 5,657 feet per second. Again, according to the same experimenter, sound travels in English steel wire at the rate of 15,470 feet per second at 20° C., and at 100° C. the speed has reached 17,201 feet per second.

SOUNDING STRINGS.

As we have already shown (p. 400), a stretched string may be made to give out sound by plucking it with the fingers, or by drawing a fiddle-bow over it. There are very few boys who are not acquainted with this fact, and something more, for they have probably, in common with most lads, tried to amuse themselves many a time by taking a piece of indiarubber string, and stretching it out by holding one end of it with the teeth, and pulling the other with the fingers, while with the free hand the string has been twanged to produce sounds. And even so boyish an occupation is of interest to the philosopher, for important scientific lessons may be derived from it. Take a piece of indiarubber string once more, and while you have it stretched out, pluck to see what kind of a note it will give out (Fig. 20). It will be a high one. Now allow the string to be much slacker, and pluck at it again. The note emitted this time is a low one. The lesson we learn, then, from this is that the note given out by the string depends upon its stretchedness—or, to use a better word, its *tension*—so that when a fiddler is tuning his instrument, he has to tighten or slacken any particular string, according as the note is too low or too high.

But this is not all, for I daresay you have heard a violinist play an air on one string after he had attuned it to his satisfaction. And he did it, you doubtless also noticed, by running the fingers of one hand diligently up and down it, while with the other he kept on bowing. Now what did all this fingering amount to? Why to this, that he was constantly altering the length of the string he was playing on, for if he wanted a high note he pressed a finger on the string low down the finger-board—in other words, he virtually made his string into a short one. On the other hand, if he required a low note, a finger was pressed on the string high up on the finger-board, so that now he was virtually bowing a long string. In fact, what he would do would be just tantamount to our taking one long indiarubber string, cutting it into different lengths, and then suspending an equal weight from the end of each. The shortest string would emit the highest note when plucked, and the longest would send out the lowest note. The note, then, which is emitted by a string depends upon its *length* as well as its *tension*.

Fig. 20. — A SOUNDING-STRING.

Now suppose we next try the effect of thickness; shall we then perceive any difference in the notes produced? We must again make it a matter of experiment by taking two pieces of indiarubber string of different thicknesses, and so that there may be no difference in length and tension we must cut each of these strings of the same length, and we must moreover stretch them both by equal weights. Upon doing this we find that the thicker string gives out a lower note than the other. And turning to a violin we see that this fact is again utilised, for of the catgut strings that are employed the thinnest is used for the highest series of notes, and thicker strings are used for lower series of notes.

These facts, then, concerning sounding-strings, which are so readily obtained, will be very easily remembered, viz., that for strings of the same material the note emitted depends upon three things—the tension, length, and thickness. And we may add that the most precise quantitative relations hold between the length, thickness, and tension, so that with an instrument properly fitted up one could manage to ascertain the tension any particular string was being subjected to when its thickness, length, and note emitted were known—in other words, one could weigh things with it, although not quite as readily as with a pair of weighing-scales. You will now be able to understand how the human voice is produced.

THE HUMAN VOICE.

To imitate the mechanism of the human voice, take a bobbin, and tie over one end two pieces of stretched indiarubber band (Fig. 21). Upon blowing down the other end, a note will now be produced. The blast of air sent down the inside of the bobbin sets the indiarubber bands vibrating, and a rough imitation of some of the sounds uttered by a baby may be obtained by bringing the palm of the hand in quick succession against the indiarubber whilst it is sounding.

Fig. 21. — BOBBIN
TO ILLUSTRATE
PRODUCTION OF
HUMAN VOICE.

In our bodies we have an arrangement of parts for voice-producing very similar to this simple piece of apparatus; the windpipe answers to the tube of the bobbin, and what are called the vocal cords take the part of the indiarubber bands. In the bobbin, however, there are no parts answering to mouth, tongue, lips, and the muscles which work them. It is these organs which make the voice of such range and quality that we are able to sing or talk.

One or two peculiarities of voices are readily understood. The difference between a man's voice and a boy's, for example, is simply the difference between a short thin string and a long thick one. We know that a high note is given out by the former and a low one by the latter, so in like manner the short thin vocal cords of a boy give out a much higher note than the comparatively long and thick vocal cords of a man. Again, we know that the note given out by a string depends upon the extent to which the string is stretched; if it be comparatively slack, we get a low note from it; while, if it be stretched tight, we get a high note, and between the two states of tension all the intermediate notes. So likewise with respect to the vocal cords, when they are pulled tight a note is obtained of a high pitch, and when they are slackened the note given out is low. From these very simple considerations we see that voice cannot be produced unless we have the following conditions:—

- (1) A current of air passing through a tube—the windpipe.
- (2) Elastic muscular bands stretching across the tube, which we call vocal cords.

- (3) Parallelism of the edges of the vocal cords, just as in our bobbin apparatus; and
- (4) Sufficient tightness of the cords to produce sounds.

ATTEMPTS TO IMITATE OR REPRODUCE THE HUMAN VOICE AND OTHER SOUNDS.

Perhaps there is no sound among the infinite variety produced in nature that has such interest for us as the sound of the human voice. With it we communicate to each other in diverse tongues all the thoughts which please or agitate us, and it is, therefore, only natural that from the earliest times there should have been attempts to make speaking machines, and sometimes even to preserve the voice. And it will be seen, as we proceed, that the more we have come to understand the nature of sound the better have our attempts to preserve or reproduce it succeeded. The efforts made during the dark times, when nothing at all was known about sound, are simply laughable to us of the present day. Thus, when men imagined that sound had a sort of corporeal existence, they did not hesitate to suppose it would be possible to bottle it, or box it up. You have many a time seen one of those comical little toys called "Jack-in-the-Box." You press down the odd inmate of the box, and close the lid over it; now, when you open the box, Jack immediately springs up, to the no small delight of all the small folk about. Well, many of the ancients looked upon sound as a sort of Jack that was rather difficult to box or bottle, but when you had got him there, he would stop any length of time, until you lifted up the lid or uncorked the bottle, and then he would immediately leap forth and be gone. A certain Walchius, for example, thought it quite possible to contrive a trunk, or hollow pipe, in such a way that it would preserve the voice entirely for days, so that one could send his words to a friend instead of his writing. And, indeed, in those dark days, it was supposed that Joseph's "hah!"—the peculiar aspirate sound you have heard many a carpenter make when he has been delivering heavy blows with his hammer—had been caught in a bottle and corked up, and was preserved among other holy relics. The same idea appears in the very amusing story of the change of King Midas's ears. Once on a time, so the ancients tell us, Pan and Apollo determined to see which could play the best on the flute and the lyre. They chose Midas, King of Phrygia, as judge. We may imagine that Midas was not a little perplexed in judging between the performances of two such god-like instrumentalists. He finally gave in his verdict for Pan. Now this decision so displeased Apollo, that he immediately changed Midas's ears into those of an ass. Even at the present day one is not over-fond of very long ears, but it would appear that Midas was positively ashamed of his new appendages, and he always tried to hide them under his cap. He managed this so successfully, that no one was aware of his deformity, save the royal barber. The secret very much troubled this man, and, in fact, became so burdensome to him, that he determined to be rid of it. He, therefore, went and dug a hole into the earth, and whispered into it, "King Midas has ass's ears," and then filled up the hole again. But we are told that the sound was not effectually buried, for there grew up a reed on the spot, which in its whisperings let out the secret to all the winds. With such notions as these, it was impossible for the ancients to make any headway in the project of originating, reproducing, or preserving the voice. When we come to more recent times, it would appear that experimenters devoted themselves entirely to *originating* sounds, voice-like or otherwise—that is, where there was no attempt to deceive people, for cheating was often carried on. M. Raisin, the organist of Troyes, exhibited before the French Court an automaton player, which performed upon the harpeichord, to their very great astonishment. The king, how-

ever, was so exceedingly curious about its working, that he would insist on the machine-player being opened, and there was then discovered within it a child of five years old, and this little musician had really been playing the harpsichord. Again, the Court of Charles II. was astonished in no small degree by a speaking head that was exhibited before them by one Thomas Irson. When you whispered into its ear it would answer in several languages. The surprise of all present was simply inexpressible, and probably the chagrin of most there would be as great as their surprise when they heard that a curious page had discovered a priest in an adjoining room answering the questions through a pipe. In fact, the feat that was being performed was nothing more nor less than a couple of individuals speaking to each other by means of tubing, as they were wont in those days to do, before the advent of the telephone and microphone.

It will be seen that sincere investigators in those times were on an apparently boundless ocean, without chart, compass, or rudder, and their position was nearly as hopeless as that of the alchemists, who were seeking to make gold out of stones, or of the mechanics who hoped to discover a source of perpetual motion. With the accession of more knowledge they became more decided in the course they ought to pursue, until, in 1736 and following years, all previous wonders in this line (and indeed all subsequent ones) were eclipsed by the productions of M. Vaucanson. He made a flute-player, which astonished the French Academy of Sciences by its marvellous mechanism and by the exact manner in which it performed the tunes it was adapted for. When the mechanism which worked the automaton was examined, one could see wheels, cranks, bellows, cords, and tubes, all arranged so as to produce the desired effect. In 1741 other automata equally wondrous were exhibited by M. Vaucanson—a figure standing on a pedestal, which played a flageolet, while with the other hand it accompanied the twenty tunes it played by beating a tambourine; and a duck, which performed wonderful operations.

As we have said, the attempts at voice-producing alone were either failures or frauds, until the Imperial Academy of St. Petersburg, in 1779, offered a prize for a research which answered these questions:—

First: What is the nature and character of the sounds of the vowels, A, E, I, O, U?

Second: Can an instrument be constructed which shall accurately express the sounds of these vowels?

FIG. 22.—
THE "I"
TUBE.



Prof. Kratzenstein gained the prize. He showed that the vowel *i* could be produced by blowing into the end (a) of a tube of this shape (Fig. 22), and moreover that each of the other vowels were obtained by blowing through a reed into the upper ends of the pipes in Fig. 23.

M. Kempelen, of Vienna, was at the same time investigating this interesting question, and attempted not only to make an instrument which would give us the vowel sounds, but also the consonants.

He made an instrument in which he copied, as well as he could, the human organs of speech. The mouth was made of a bell-shaped piece of elastic gum, and to the mouthpiece was added a nose made of two tin tubes. Now you will readily perceive that the nose is in some way concerned in the pronunciation of the consonants *m* and *n* by closing the

nose and calling them out aloud. The artificial nose of Kempelen's apparatus communicated with the mouthpiece, and he obtained the letter *m* by closing its mouth, and keeping its two artificial nostrils open; when he wanted *n* only one

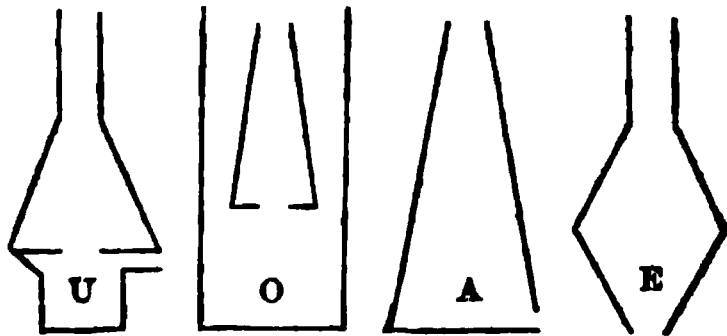


Fig. 23.—OTHER VOWEL TUBES.

nostril was closed. He was able at last to produce with his apparatus entire words, such as *astronomy*, *opera*, and so on. We must now, however, pass over the researches of subsequent workers in this field—Mical, Willis, Wheatstone, and others—and come to the *phonograph* or sound-writer, which fulfils the prophecy made by Sir David Brewster, although, perhaps, in a way he little expected—a prophecy made more than fifty years before the invention, when he said, “We have no doubt that before another century is completed a talking and a singing machine will be numbered among the conquests of science.” A word or two first on a speaking-plate arrangement, invented in 1880, will not be without interest to you.

A SPEAKING-PLATE.

By means of the apparatus depicted in Fig. 24 Mr. W. H. Preece made a disc of thin iron (*d*) speak, and give out other sounds. This was how he managed it:—A very thin platinum wire (*w*) was attached to the centre of the disc (*d*), and at the other end to the support (*s*), and then tightened up. Wires were now taken from each end of it to a microphone (*m*) and battery (*B*). When the microphone was spoken to the disc (*d*) reproduced the sounds.

Now, when electricity is passing through a wire (*w*), the wire is heated, and being exceedingly thin it soon gives off its heat. And as we shall see before long that heat lengthens metals, and that they shorten again upon cooling, it is plain that a short and sudden current of electricity passing through *w* would lengthen and shorten the wire quickly, thus giving a minute to-and-fro motion to the disc (*d*). When one speaks into the microphone (*m*) the amount of electricity passing through *w* is altered very rapidly, and consequently the lengthening and shortening of the wire are extremely rapid; the rapid to-and-fro motion of the disc (*d*) which results, imparts that peculiar to-and-fro motion to the air which constitutes sound.

FIG 24.—PREECE'S EXPERIMENT.

This is a very interesting fact that we have now learnt, viz., that a plate of metal may be made to give out speech-sounds, in other words, to beat the air in such a fashion that the plate seems to speak; and in the *phonograph* invented by Edison we see that voice will make a disc vibrate, and after the voice is silent this self-same disc may be made to vibrate again in precisely the same way, and give utterance to the thoughts which were before imparted to it.

THE PHONOGRAPH.

The “drum” of the ear, as the word itself would make you guess, is a membrane stretched tightly at the end of the ear-passage. When sound is produced, this drum begins to move backwards and forwards, and being attached to a string of small bones within the head, these are agitated, and in their turn cause other minute bodies to move, notice of the fact at last reaching the brain by means of the nerves. Now, one portion of the phonograph is very like the external ear; it is the mouthpiece (*m*, Fig. 25). You may call it in your own mind the ear of the phonograph, for you speak into it just as you would speak into the

ear of a deaf person. At the hind end of this mouthpiece there is a very thin metal plate, which answers to the drum of the ear, for when a sound is uttered in its neighbourhood it begins to vibrate. The plate has a small steel pin attached to its centre, hence you will understand that when the thin plate is vibrating anything placed in the way of the style would get a most rapid kicking, for the style vibrates along with the plate which carries it. You will perceive that this style is not unlike the one we used in our experiment with the tuning-fork, and its use is precisely the same, for it is employed in sound-writing, which we shall now proceed to explain. In front of the drum there is a cylinder (c), and it is spirally grooved. Suppose now you were to wrap a sheet of tin-foil around this cylinder, and to place the mouthpiece so that the style in its movements would beat against the foil covering the groove; it is

Fig. 25.—A SPEAKING MACHINE: THE PHONOGRAPH.

style dipping into the very first indent, then upon turning the cylinder at the same rate as before the style would be moved rapidly backwards and forwards, with precisely the same movements it had when the sounds were originally being uttered, and it will appear to you not improbable that the plate, under these circumstances, would give out sound, as in the case of Preece's disc; such is the case. In this way you may commit songs, speeches, &c., to sheets of tin-foil, which may then be used in the phonograph at some subsequent period to give out the same sounds faithfully again.

There must, of course, be uniform motion in the drum (c), so that it is turned by clock-work, represented at the right of the woodcut, and to insure movement of the cylinder in front of the style, the shaft (s) is likewise spirally grooved, and fits into a knife-edge at one end of the cylinder.

HOW TO MAKE A MICROPHONE.

Under the head of "Cathedral Bells" we have spoken of the principle on which Sir Charles Wheatstone constructed his microphone, so named because it appears to magnify sound. What is now generally known as the microphone is a very different instrument, due to the researches of Professor Hughes. It is easy to

make, and supposing you possess a Daniell's cell and a telephone, you may make a microphone out of a lead pencil (Fig. 26). Take a piece of lead pencil about two inches long, and sharpen both ends. Two shorter bits, say each about half an inch long, are now taken, and a portion of their sides cut off, so as to expose the lead. For this purpose very thick lead-pencil will answer better than the ordinary thin drawing-pencil. These short bits must both be of the same length, and in the middle of each of their leads a round cup must be drilled with the point of a penknife. These cups are to hold the points of the lead-pencil we have before referred to. In the backs of each of the short bits puncture round holes, so that when wires are inserted they will be in contact with the leads of each. And now, with two pieces of cigar-box, we possess all the material for putting together the microphone. Suppose the larger piece of cigar-box is three inches by four inches. Attach to one end a lesser upright piece, which may be fastened by screws or glue. Now glue to the upright piece of wood the two short bits of pencil, at such a distance from each other that the long piece of pencil may fit easily into their cups. Wires may now be placed in the holes at the back of the short bits of pencil, and connected—one to a telephone at some distance, and thence to the battery, and the other to the remaining terminal of

Fig. 26.—THE MICROPHONE.

the battery. It sometimes happens that lead pencils are rather refractory when applied to this purpose, so that if you require a really efficient instrument, gas-carbon will have to be procured from the gas-works, and out of two small bits cubical supports may be rubbed by friction against a plane surface of stone, the operation being accelerated by the use of water and sand. And one long bit may likewise be worn down in the same manner, to answer for the pencil with two points. These may now be put together precisely like the pieces of lead-pencil, and then a really efficient microphones will have been made. As to the gas-carbon, it is a waste product, one which the gas-engineer is glad to get rid of, so that it is probable you may procure for nothing at the gas-works as much of it as ever you can carry away.

CHLADNI'S FIGURES.

In the phonograph we have a very marked effect produced by aerial vibrations shaking, as it were, the plate with the style attached. Much greater indeed, then, must this shaking be when the plate is the origin of the sound, and in fact it is so marked that if you have a horizontal plate of metal giving out a sound, you will find that particles of sand dance up and down on its surface as if they were bewitched. But all parts of the plate evidently do not move alike, for the sand collects in lines, geometrically arranged, and is kicked away from comparatively wide areas, as you will see in the accompanying sketch of four circular plates (Fig. 27) that have been set sounding with sand strewn on their surfaces. Such sand-patterns are known as Chladni's figures, a celebrated

scientific man of that name having discovered how to produce them. The device he employed for obtaining the figures was this:—A square or round plate of glass,

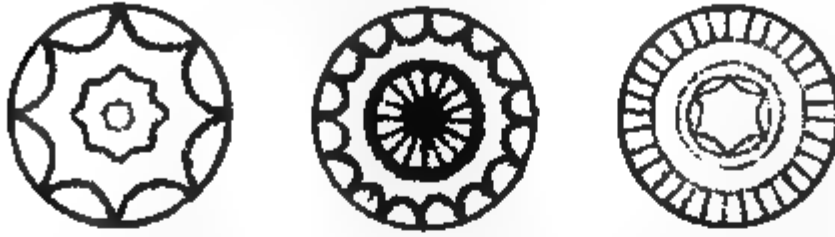


Fig. 27.—CHLADNI'S SAND FIGURES: CIRCULAR PLATES.

supported horizontally upon a stand, was clamped at its centre, as in Fig. 28. Fine white sand was now scattered over its surface, and the plate was made to emit a note by drawing a fiddle-bow across one edge. The sand immediately commences to jump about, and ere long a definite pattern is produced, which you may preserve by gently laying over the surface of the plate a black sheet of paper freshly gummed, when the white sand will adhere to the surface of the black paper. If you imagine black sand to have been used, and the patterns to have been transferred to white paper, then you have a series of patterns in the accompanying figures (Fig. 29), which have been obtained from a great variety of sounds.

Fig. 28. — HOW TO PRODUCE CHLADNI'S FIGURES.

We have thus seen, while we have been thinking and experimenting on Sound, that substances which appear to us to be quite at rest are trembling in a most intense fashion, a fact which is detected for us by the microphone, and in a more common way in some cases by the formation of Chladni's figures, the writing on smoked glass, and the kicking of a pendulous bit of wax. The extent of motion of the solid particles is certainly very minute here; but we shall next have to turn our attention to phenomena due to movements more minute still, and therefore in some respects more wonderful. These phenomena we shall deal with under the heads of *Light* and *Heat*.

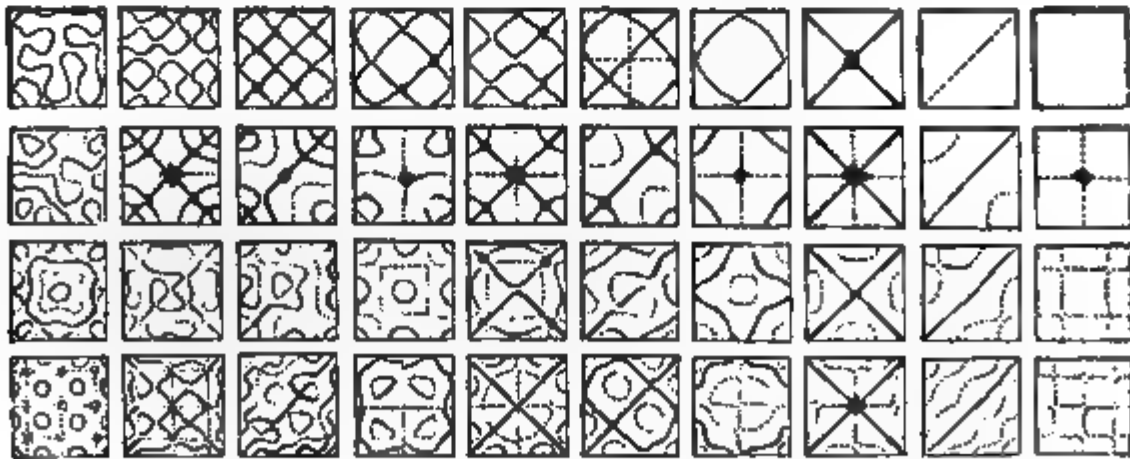


Fig. 29.—VARIETIES OF CHLADNI'S FIGURES.

LIGHT.

At the very outset we find ourselves exclaiming, with Colley Cibber's "Blind Boy"—"O say! what is that thing called light?" And although we are blessed with sight, can look with a sense of keen satisfaction at the blue canopy of heaven, and turning our eyes earthwards, take no less a pleasure in gazing at the green carpet on which we are treading, we confess to having a little difficulty in saying what light is. It is seldom, however, that a boy is deterred by a difficulty from trying to solve a riddle or from getting at the bottom of a puzzle. If he at first fail, he tries again, nor gives up trying until thoroughly convinced that all farther efforts are useless. Here then is one of Nature's riddles put in the simple question, What is light? And although it took some great men, who are now dead and gone, a long time to do it, and a great deal of labour, we are now pretty well satisfied with their explanations. We may therefore not unprofitably spend a little while in trying to solve this riddle that Nature puts to us, and then we can compare the answer we arrive at with that given by the philosophers who lived during the last century and at the fore part of this.

SOURCES OF LIGHT.

A great source of light is the sun that rises every morning, sometimes long before we rise, and sheds its light over half the earth. Then, after running through its daily course once more, it sinks behind the western hills, and a little after we are left in darkness, save when the moon sends us the light it has borrowed from the sun. We then employ artificial lights for our illumination, gas-lamps in the streets, gas-lights in the houses, and, where gas is not made, candles or oil-lamps. Whatever this light may be, then, it is plainly produced by the sun, by many of the stars, and by burning candles, gas-jets, or oil-lamps; and to tell that each of these bodies is sending forth light our eyes have to be open, for if blindfolded in a dark room one could not tell when a candle was brought in. Our first step, then, in the solution of the riddle is this conclusion: that something enters the eyes and gives us the sensation of light. It will be as well, then, before proceeding farther with our un-riddling of this problem, if we examine into the nature of the eye.

THE EYE.

The eye of a cow or sheep is sufficiently like ours to let us understand what we want to know. Procure a sheep's eye from the butcher's, and allow no squeamishness to deter you from cutting it up as we shall now direct. We are quite aware that the mere idea of doing such a thing would make many people sick, but the feeling is conquerable, and ought to be conquered, for of all the organs that the animate portion of nature has been endowed with, not one is so beautifully or admirably constructed as the eye, and as an instrument it works so well that it appears not a little presumptuous in certain philosophers who have attempted to find fault with it.

Take note, first, that the eye has a window to it of the shape of a watch-glass, and under the window there is a coloured ring-shaped curtain. You can see so much in your own eyes upon looking in the looking-glass. When the light of the sun pours fiercely into a room we draw down the curtains to make it more comfortable, and so in like manner, if while you are looking in the glass some person bring a strong light near the eyes you will see the ring-shaped curtain draw to, in order to make it more comfortable within. In each eye, then, we have a wonderful organic edifice, with one window to it, and a coloured curtain under that. We now want to see how it is furnished.

With a sharp penknife cut a hole into the window (cornea) of the sheep's eye; a watery fluid will spurt out if we happen to be pressing the eye-ball. This fluid is called the aqueous humour. Make the incision into the cornea bigger, in fact,

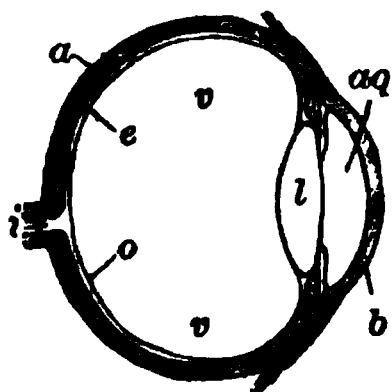


Fig. 30.—THE HUMAN EYE.

cut it right across, and press the eye-ball more than before, and now there comes out a round lozenge-shaped body, perfectly colourless and as transparent as ice. Probably the ancient anatomists had its ice-like appearance in mind when they determined to call it the *crystalline* lens, or they may not have had; let that be as it may, however, its name is a very appropriate one. Make the incision larger still, so as to cut the eyeball in two. The remainder of the eye is seen to be filled with a transparent and colourless jelly-like substance, so glassy in its transparency that it is called the vitreous humour. In the section of a human eye presented in Fig. 30 the positions of the various parts are shown: of the window, or cornea (*b*), the aqueous humour (*aq*), the crystalline lens (*l*), which is flatter in front than behind, and the vitreous humour (*v*). And now a few words about the walls of the eye that we have cut through. There are three layers, the outermost (*a*) being thickest, the middle one (*e*) having a lining of black colouring matter, and the innermost (*o*), called the retina, being the screen upon which light falls after it has passed through the window, and through the transparent aqueous humour, lens, and vitreous humour. Now the lens, as we shall better understand after a while, projects on to the retina a beautiful picture of external objects, and notice of this is sent along a white cord to the brain. Look for this white cord at the back of the sheep's eye; it is called the optic nerve (*i*).

We have already seen (p. 404) that the sensation of light could be produced by rubbing the eye in the dark, and what happened then was this: upon pressing the eyeball the vitreous humour was squeezed against the retina at a point just opposite to the finger that was being used, and a round figure of light was obtained. Plainly, then, when an external object—as, *e.g.*, a candle—sends its rays into the eye the retina is disturbed, and the agitation being sent along the optic nerve (*a b*) in direct communication with the retina, a message is carried along to the brain (*c*), which gives us the idea of a candle, or whatever else the light source may be (Fig. 31).

LIGHT PRODUCED FROM SUGAR, ETC.

In the most common ways of producing light—those, in fact, with which we are all acquainted—there is burning going on, and the substances we are dealing with gradually disappear, being changed into others entirely different in character. Thus the light from a common candle comes from the burning of the fat or tallow which rises up the wick from the cup at its foot, and the fat during the process of burning is changed into water and carbonic acid, which mix with the air. It is possible, however, to get a very faint light without any burning of this kind. If we take two pieces of sugar into a dark room, and strike them together, a faint light will be seen, which results from this knocking. We are unable to perceive that any change has taken place in the sugar, for it is white and crystalline as before, and, so far as we know, entirely unaltered, having its attributes of whiteness, sweetness, and so forth, as at first. Light, then, has been produced here without any burning.

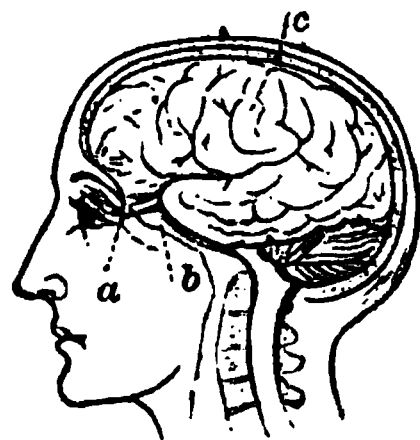


Fig. 31.—POSITION OF THE EYE AND ITS CONNECTION WITH THE BRAIN.

Again, we can get light from whitewash without there being any change in it, similar to that which takes place in the substances of the candle. Heat the poker to redness, and take it into a dark cellar with whitewashed walls. Now, when the poker has just cooled sufficiently so that its redness is no longer visible, run the heated end of the poker over the whitewashed wall. Some of the whitewash will adhere to the poker, and it will now, in the darkness, appear luminous.

Fish sometimes appears luminous in the dark, as do many other substances. *Phosphorescence* is the name applied to such extraordinary cases of the production of light, and it will be observed from the foregoing simple experiments, which any lad may try, that the light is a very faint one—so faint that if there be another light present the phosphorescence is not visible. Like the light of the stars, it can only be seen in darkness.

WAVES AND ETHER.

Of course you have hundreds of times, boy-like, sent stones into the water, and dreamily watched the ripples grow bigger and bigger until they have washed the opposite shore of the river or pond, and the reeds or tall grass that grow there have been disturbed by these ripples. The motion of the stone we pitched into the water has been communicated from water particle to water particle, until the particles in contact with the reeds have communicated their borrowed motion to them. Spread out a pack of cards on the table, one resting partly over the other, as in *a*, Fig. 32. Now, upon lifting up the first card and turning it over, each of the other cards follows suit, and we have a card-wave (*b*) advancing along the table, although each individual card keeps its own place. So here in these water-waves they travel along, but the water particles individually move only a few inches. May there not, then, be some material which conveys the motion of the atoms in the candle flame or phosphorescent substance, and communicates it to the very delicate reeds (rods and cones) of which the retina is largely made up? To such a medium, which many—nay, nearly all—scientific men of the present day suppose to exist has been given the name of luminiferous ether. And do not let the youthful reader confound this ether we are now speaking of with the ethers the chemist deals with. The latter may be held in bottles, but the luminiferous ether exists among the particles of these bottles, and is evidently as free to move within the transparent substances of the eye as a water particle is within a pond of water.

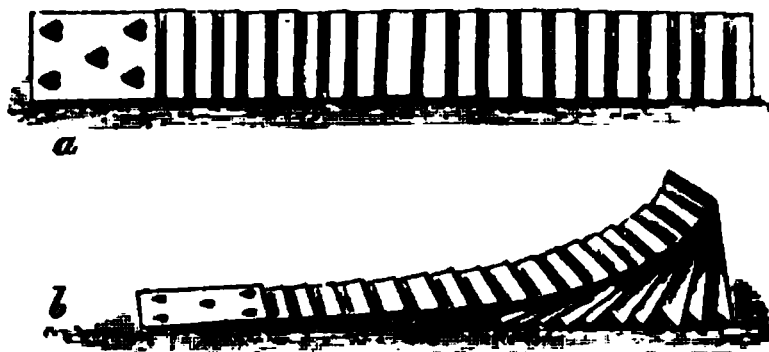


Fig. 32.—A WAVE OF CARDS.

THE ANSWER TO "WHAT IS LIGHT?"

It would appear, then, from the evidence we have considered in trying to solve this question, that light is very probably a wave-like motion of a peculiar substance that connects the sun to the rest of the wandering bodies which, like the earth, move around it; and that furthermore this ether, as it is agreed to term it, connects one star to another, and at the other extreme one atom to another.

At one time it was thought that luminous bodies sent off exceedingly minute particles at a prodigious speed, and that these particles entered the eye to produce the sensation of light. We think so now no longer, and preference is given to the very simple theory we have attempted to sketch.

LIGHT PROCEEDS IN STRAIGHT LINES.

If you have ever been in a very dark room, where external daylight could enter only by a chink in the shutter or through the keyhole of the door, you will have noticed that the light proceeds from the chink or key-hole across the room in a perfectly straight line, a line much straighter than you could draw for the same distance. The fact is strikingly manifest when much dust is floating in the atmosphere of the room.

The very same thing you will have observed on a larger scale when, in what would otherwise have been a continuous pall of cloud hanging over the earth, there has been a rift through which the sun's rays could pass. On such occasions the sun's light has reached the earth in what seemed to be long *straight* columns. We see the same fact illustrated on misty nights in the straight beams which issue from a cabby's lamps or from a policeman's bull's-eye. To these you will be able to add other examples which you will continually come across. Let us take it as proved, then, that light proceeds in straight lines, and we shall be able

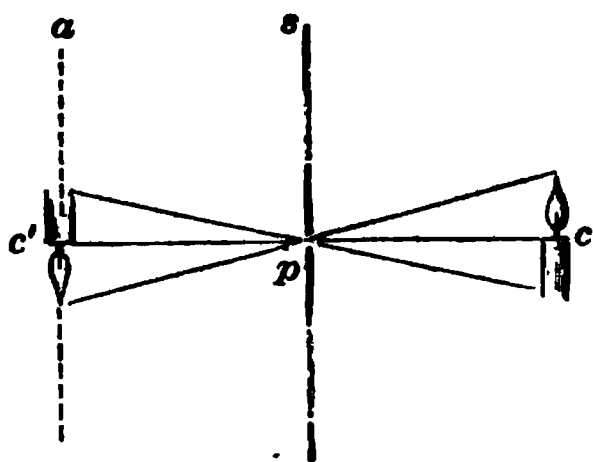


Fig. 33.—LIGHT PASSING THROUGH A PIN-HOLE.

to reason out what will take place when the light from anything passes through a pin-hole (Fig. 33). If *s* be an opaque screen with a pin-hole in it at *p*, and *c* a candle placed on one side of it, then it follows that if another screen be placed in the position of the dotted line (*a*) there ought to be cast on it an image of *c* upside-down; for if you draw a straight line from the tip of the candle through the hole at *p*, this line will represent the path of the light from the tip. A similar line drawn from the base of the flame through the pin-hole will show us the direction such rays will take, and if we continue these lines to the dotted one, it is plain to see that in the

image produced the top of the flame (*c*) will now be the bottom, and the bottom the top, giving us the inverted image of the candle (*c'*). This is well shown experimentally in the *pin-hole camera*.

HOW TO MAKE A PIN-HOLE CAMERA.

Make a strong cardboard tube about a foot long and two inches in diameter, by rolling a strip of cardboard round a wooden cylinder like a rolling-pin, and then fastening with glue and withdrawing the wood. Blacken the inside of it, and close one end with tracing-paper. Make a second tube of stiff paper, by rolling the paper round the cardboard tube, then gumming, and after that closing one end with stiff paper. The inside of this second tube must also be blackened, and a pin-hole must be made in the middle of the stiff paper end. We have now two tubes, and the inner one comfortably slides within the other, so that its tracing-paper end may be brought very near to the pin-hole of the other tube. Now, if the pin-hole be directed towards a window, candle flame, or any bright object, upon looking at the end of the inner tube an inverted image of the window or candle flame will be seen projected on the tracing-paper (Fig. 34). This image will be seen to alter in size upon sliding the tracing-paper in and out.



Fig. 34.—A PIN-HOLE CAMERA.

What we have here seen results from the fact of light travelling in straight lines. For if light from the candle (*c*) proceed in straight lines through the pin-hole (*p*) it is evident that the light from the tip of *c* will, after passing through *p*,

be cast on to the lower side of a screen at *a*, while the light from the lower part will be cast on the upper side of the screen at *a*, as we have before shown. It is, moreover, easily seen from the diagram that the size of the image will be less when the screen is thrust in as far as *b*.

Instead of a screen of tracing-paper, you may make what will be more durable, a screen of ground glass, by rubbing the surface of a piece of circular window-pane until quite unpolished. This may now be fixed in the position of the paper screen, and will answer well.

SHADOWS.

Many a time in thoughtful mood you will have watched the dancing shadows formed by the flickering firelight, and perchance, as your own shadow has suddenly appeared on the wall behind you, you have given a start at its giant size and extraordinary form. From what we have said you will now readily perceive the cause of such a shadow, which is briefly this—that light from the fire travelling in straight lines cannot pass round corners to any marked extent, so that when an object stands in its way all behind it is in darkness, and the form of this area of darkness will vary with each movement. Hence, from the same object employed as a light obstructor a wonderful variety of shadow-forms may be produced, and perhaps in nothing is this so remarkably shown as in hand-shadows. In the accompanying woodcut (Fig. 35) you have a variety of hand-shadows with the particular disposition of the hands which is required to produce them. Other forms of hand-shadows you will doubtless find out as you are practising these, and they will afford many a half-hour's amusement as you lead out your shadow-animals, including the bear and the goat, the dog and the pig, and a host of others. We need scarcely give any directions as to their production, for if the gas-light be, say, in the middle of the room, and you want to cast the hand-shadows on a particular wall, the hands are brought between the gas-light and the wall, and their distance from the former is regulated according to your wish as to the size of shadow you want, &c. We may add that you will be able easily to represent the jaws of your hand-shadows moving by bringing together and separating the parts which give rise to the shadow of the mouth. Moreover, if you are able to imitate the sounds of any of the beasts whose hand-shadows you can form—as, *e.g.*, the bark of the dog, the bray of the donkey, and the lowing of the cow—your entertainment becomes complete.

We must pass on, however, to the scientific aspect of our subject, and ascertain something more about shadows. Seeing that a shadow is an area where light is absent, and is defined by a larger surface where light can fall from the light source, it is easy to see that a perfect shadow will be one whose blackness is perfect, *i.e.*, one upon which no ray of light can fall. Perhaps such perfect shadows can be formed only under very exceptional circumstances; we can, however, arrive at important facts by comparing shadows of the same object that are cast by different lights. Suppose you take a round stick—as, *e.g.*, a whip-stock—and insert it in the neck of a bottle, and then cast a shadow of the stick on to the wall by means of two lights, say a paraffin-oil lamp and a common wax candle (Fig. 36). If there be other lights in the room put them out, and now stand up the bottle and whip-stock near the wall, with the candle and lamp at the same distance from the wall and also from the upright stick. You will see that neither of the shadows cast on to the wall is a perfect one. Now this experiment is as interesting as it is simple, and we cannot do better than study it well. If the lamp (*a*) and candle (*b*) produced perfect shadows in this experiment, they would both be of the same degree of blackness. It is pretty evident, however, that the shadow (*a'*) cast by the lamp is blacker than the shadow (*b'*) cast by the candle.

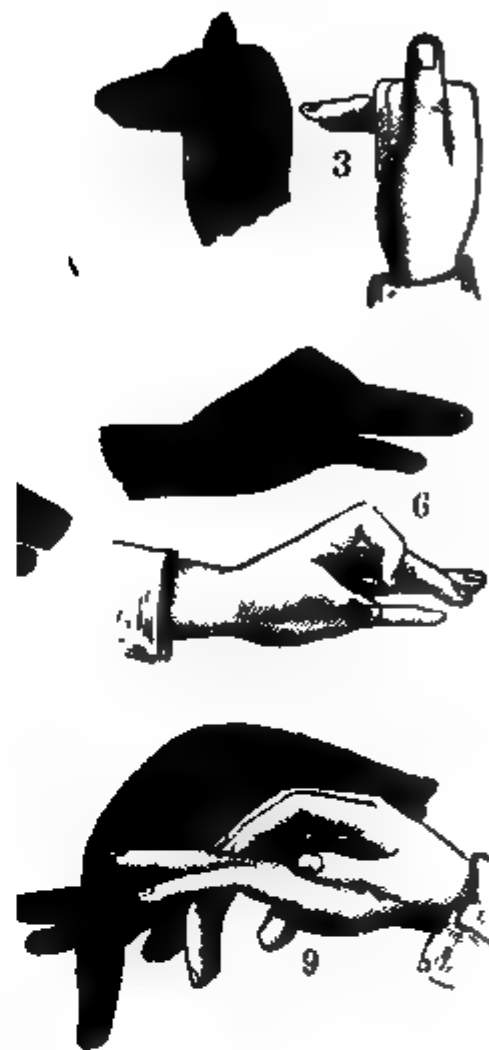


Fig. 35.—HAND SHADOWS.

1, Reindeer; 2, Charols; 3, Hound; 4, Camel; 5, Pig; 6, Goose; 7, Wolf; 8, Goat; 9, Elephant; 10, Hare; 11, Bear; 12, Ox; 13, Dog; 14, Butterfly; 15, Donkey.

Why? It is plain that each light cannot illuminate the shadow it produces, but each light illuminates the shadow produced by the other, whence it follows that, if we suppose a' and b' to be perfect shadows to start with, the lighter of the two now must be illuminated by the stronger light. The experiment, therefore, teaches us that the paraffin-oil lamp casts a stronger light than the candle. Now remove the lamp farther away from the wall, until the two shadows, a' and b' , have each the same degree of blackness: a' now appears a yellowish sort of shadow compared with b' , and as a' is illuminated by the candle-light, it plainly follows that the light of the candle is of a yellower tint, taken all together, than that of the paraffin-oil lamp. This interesting fact is shown also by the spectroscope, as we shall see farther on.

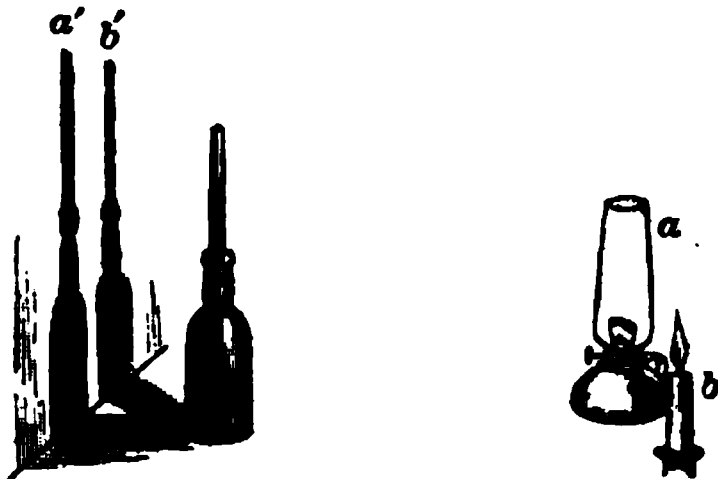


Fig. 36.—A COMPARISON OF SHADOWS.

PHOTOMETRY.

Would it be possible to tell how much better an illuminator the lamp is than the candle? Because if one could do this, it would plainly be a useful thing as well as an interesting one. It can be done, and the way is so simple that any lad can understand it who knows how to do simple proportion. In the experiment we have just finished the lamp was removed from the wall until the shadow it produced was of the same degree of shade or blackness as that of the shadow produced by the candle. When we compare lights to see which are best, this is exactly what we do. Now for the measuring and calculation. With a tape-measure take the distance of the candle from the wall, say five feet, and also the distance of the lamp from the wall, say eight feet. Each of these distances has now to be multiplied by itself ($5 \times 5 = 25$; and $8 \times 8 = 64$). The numbers 25 and 64 which we thus obtain tell us their respective lighting-up power—that is, if the illuminating power of the candle be called 25, that of the oil-lamp will be 64. Now comes the simple proportion sum. If the lighting-up power of the candle be represented by 25, and that of the oil-lamp as 64, what would the illuminating power of the lamp be if we call that of the candle 1?

$$25 : 64 :: 1 : x. \quad x = \frac{64}{25} = 2\frac{1}{2} \text{ nearly.}$$

The result of our calculation tells us, then, that the lamp is equal to $2\frac{1}{2}$ candles.

NATURAL SHADOWS.

Wherever there is light there must be shadow, if there be anything or any irregularity on the surface where the light is falling. The shadows produced by the sun, *e.g.*, extend throughout all the solar system. Each planet, our earth included, which revolves round the sun, has a sugar-loaf-shaped shadow, which is for ever behind it; when the planets' moons enter it they are eclipsed, and when any particular spot on the surface of the planet enters this shadow it is night for it. Besides being cast upon the solid ground, shadows may be projected on to cloud or fog. Aeronauts often see a shadow of themselves and ear surrounded by a sort of rainbow projected on the clouds below when the sun has ascended high up into the heavens. The Spectre of the Brocken is probably of the same nature, for when the observer is on the summit of the Brocken at day-break or sunset—that is, when the sun shines on to him nearly in a horizontal

direction—he can sometimes see, upon turning his back to the sun, a shadow of himself which mimics his every movement. Every mountain has a shadow, and under certain circumstances the shadows of the mountains of the moon are interesting objects to see. Perhaps the most remarkable of mountain shadows on the face of the earth is that of Adam's Peak, in Ceylon. This is a lofty mountain which casts a shadow at sunrise over land and sea to a distance of seventy or eighty miles. As the sun rises the shadow of course alters; and the way it ought to alter will be seen by sticking a pin in the middle of the table to represent Adam's Peak, and bringing a candle to the edge of the table to represent the rising sun. Now, as we bring the candle higher and higher, the shadow of the pin shortens. So it is in the case of Adam's Peak, but the curious thing about it is this, that as it rapidly approaches the mountain it appears to rise above the spectator in the form of a gigantic pyramid of shadow! It is supposed to be due to mirage (p. 442).

SHADOWS WITHIN THE EYE.

We need not go to Ceylon, however, to see some wonderful shadows, for we can see them in our own bodies, extraordinary as that may appear. In the retina there are a great number of blood-vessels branching in and out in all directions after the manner of such tiny tubes, and if you wish to see their shadows you may do so in a very simple way. Go into a dark room and take a candle with you; now close one eye with one hand, and hold with the other the candle, which must be continually moved up and down, two or three inches from and on one side of the open eye (Fig. 37). While you are staring at some imaginary object in the darkness, before you there will suddenly appear black and tree-like shadows of these blood-vessels on a very slightly reddish ground. You see there the apparently big stems stretching up and down in crooked fashion, and proceeding from them one perceives untold lesser branches—a truly fine sight and a marvellous one. We are fearfully and wonderfully made!

Fig. 37.—HOW TO SEE THE SHADOWS OF THE BLOOD-VESSELS IN THE RETINA.

SPEED OF LIGHT.

The results of scientific research have shown us again and again that we live in a world of wonders, and perhaps the most wonderful thing we have yet ascertained is the prodigious speed with which light passes through space, for it has been conclusively shown that light passes through hundreds of thousands of miles just while you are saying "Tick, tack!" About ten years after Newton's discovery of the composition of white light, a Danish astronomer, Olaf Rømer, while studying the eclipses of Jupiter's four moons, saw clearly that such observations would enable one to ascertain the speed or velocity of light; and this arose out of an apparent want of punctuality these moons had in entering Jupiter's shadow. As you will perhaps know, most astronomical events—at least, those concerned with the sun and planets—can be foretold not only to the day or the hour, but also to the exact fraction of a second; and astronomers were able to say when any particular moon should enter Jupiter's shadow, for everything

had been ascertained which would enable them to calculate the time with extreme precision. But a moon would sometimes enter the shadow too soon, sometimes too late, and seldom at the time set by the disappointed astronomer. In Fig. 38. let *J* represent Jupiter, and *M* one of his moons. The astronomer on the earth will see this moon enter Jupiter's shadow. Two positions of the earth are represented by *a* and *b*, and at *b* an astronomer would be about 190,000,000 miles farther off Jupiter than at *a*. Now Rømer found that these eclipses always happened earlier than they were expected to do when the earth was approaching

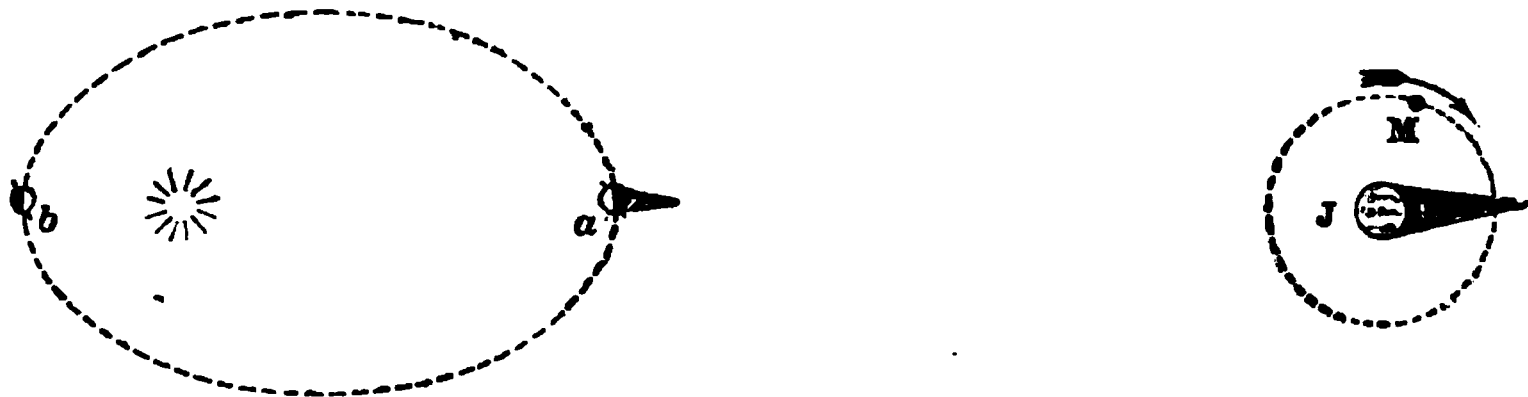


Fig. 38.—HOW THE SPEED OF LIGHT WAS FIRST ASCERTAINED.

the position *a*, and they seemed to be more and more behind time when the earth was going towards *b*, and it thus seemed to convert into a certainty what had before been suggested, viz., that these unpunctualities of the moons were really owing to the fact that light takes time to pass through space. When Rømer, therefore, found that the difference between the observed time of an eclipse of one of Jupiter's moons seen from *a* and an eclipse of the same moon seen from *b* was more than a quarter of an hour, he said to himself, "This arises from light taking more than a quarter of an hour to travel across the earth's orbit from *a* to *b*."

Calculations were now made, from which it appeared that light travels at the enormous speed of 192,500 miles in a second, and after Rømer's time astronomers made no more mistakes in predicting eclipses of Jupiter's moons, for they had learnt precisely what to allow for any given position of the earth in its orbit. And in this wise was first ascertained the velocity of light, a speed which we put down in figures, although we can hardly grasp it; and much less can we grasp an idea of the immensity of the universe, the light from the stars on whose confines may not yet have reached us since their creation, although travelling through space with such an enormous speed.

THE AGITATION PRODUCED AT THE BACK OF THE EYE BY LIGHT TAKES TIME TO TRAVEL TO THE BRAIN.

When you rapidly whirl round a stick that is lit up at one end, you are well aware that you produce a ring of fire. This is a very common experiment amongst boys; and if we stay to inquire why there appears a ring of fire, the explanation we arrive at will give us the key to a whole host of similar phenomena. Suppose an instantaneous flash of light were to enter the eye, the agitation produced in the eye would require about one-eighth of a second to subside, so that the light would appear to us to exist a fraction of a second after it had really vanished. The impression produced by light is therefore said to persist or continue for a sensible interval of time. Thus, when you whirled round the lighted stick, a complete circle was described (Fig. 39), from starting at *a* to getting back to the same point in less time than it took the first impression of light at *a* to die out; thus an idea of

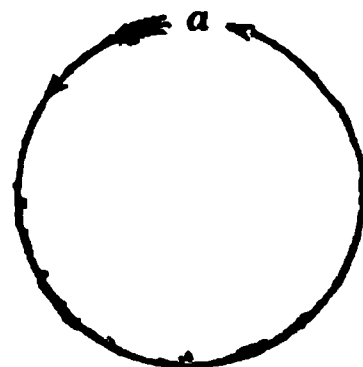


Fig. 39.—THE ILLUSION OF A FIRE-RING.

a continuous ring of light arose, for the impressions, produced at various stages of the stick's progress around, all ran into each other, giving rise to the illusion of a

ring of fire. The same phenomenon is observed many a time in the course of a day. If it be raining, the drops descend so swiftly that it is impossible for you to follow them in their course, and instead of seeing rain-drops you appear to see lines of rain, and so the artist represents them (Fig. 40). Again, when you look at a wheel which is rapidly whirling round, you are unable to see the spokes individually, as they pass before you so quickly, and they seem to merge into each other, producing a continuous circular surface, which appears to be trans-

Fig. 40.—A RAIN SHOWER.

Fig. 41.—COLOUR-DISC FOR ROTATION.

parent; and just in the same way when you spin a peg-top that has been coloured by strips of colour radiating from the centre of its upper surface in this way, you are unable to distinguish any of the individual colours, and they appear to merge into a single tint. If you paint your top with seven radial strips of colour in this way (Fig. 41), and let the colours, moreover, be as near like the rainbow colours as you can get them, you will find, upon spinning your colour-top rapidly round, that the tint produced by the merging of these various colours in the eye is a sort of grey, and probably it would be white if you could have proper pigments to paint the sectors perfectly and of the required proportions on your top.

OPTICAL ILLUSIONS FOUNDED ON THE PERSISTENCE OF IMPRESSIONS.

There are a number of optical illusions which are founded upon this peculiarity the retina possesses of retaining impressions for a definite period. Perhaps the illusion produced by the thaumatrope is as simple and interesting as any of them. A piece of cardboard is shown to you with the figure of a cage on it. The performer now says, "I will put a bird in it." The card is twirled rapidly round, and sure enough a bird appears in it. The thing is simple enough. On the other side of the card he has a bird drawn, and when the card is rapidly twirled round the image of the cage in your eye has not time to vanish ere it is accompanied by that of the bird. You may readily make these thaumatropes for yourself if you can draw at all. Take a piece of cardboard, about an inch and a half long and one inch wide, and on each side draw faint pencil lines (Fig. 42). *ac* and *bd*, joining the opposite corners; where they meet at *e* you may regard as the middle of the card. Now draw the figure of a bird with its feet resting on *e*, and on the other side draw a cage with the point *e* fairly in the middle of it, and likewise with a horizontal bar passing through it. On one side of the card you have now the bird, and upon turning round the card on its edge, *i k*, you see on the other side the figure of an empty cage. Of course, if you had turned the bird side over on the edge *h i*, the picture of the cage would have

appeared upside-down, as in the next figure of a horse and Red Indian (Fig. 43). You now seize the strings (*s s*) between each finger and thumb, and twirl the card round rapidly, when the bird will appear to be perched on the horizontal bar within the cage.

You may vary your figures by having a horse on one side and a rider on the other, a dog running, with a rat on the other side running too, and so on; and upon twirling the strings the riderless horse will have a rider, and the rat will appear to be chased by the dog, and so on.

In the praxinoscope (Fig. 44) a greater variety of movement still is obtainable, as you may have represented a juggler performing difficult feats, boys playing at leap-frog, or a swimmer striking out in the water. On the inside of a shallow cylinder of metal or cardboard a number of figures of the object whose movements we want to exhibit are painted, each figure representing a phase in the round of movements. This cylinder rotates around a perpendicular axis, mounted by a lamp, which sheds light on the revolving figures. A set of small mirrors are arranged all round the foot of the lamp, and they rotate along with the rest of the cylinder, so that when you have the cylinder spinning round you see, as it were, a moving figure in the looking-glass before you, a juggler tossing up balls with his hands, a swimmer timing the movements of his hands and feet, as swimmers unconsciously do, or a couple of boys going through all the operations of playing at leap-frog. If there be, say, eighteen figures on the interior of this cylinder in the praxinoscope, and these are designed, when revolving

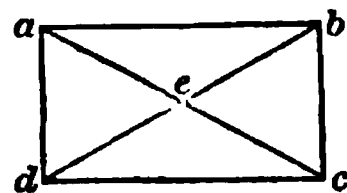


Fig. 42.—HOW TO MAKE A THAUMATROPE.

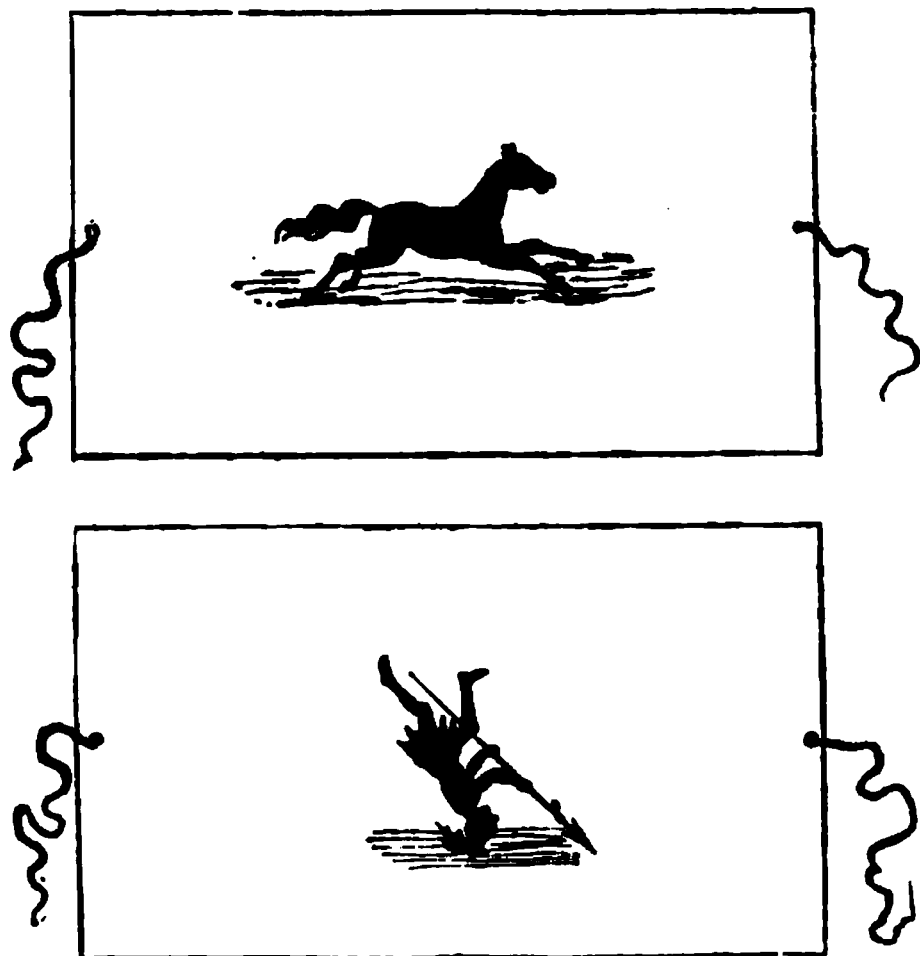


Fig. 43.—THE THAUMATROPE.

to represent the movements of a couple of boys playing at leap-frog, then the first nine would represent a boy giving a back, and the leaper in every position, from taking the spring to the moment when he, for an instant, is over his comrade's back open-legged; and the remaining nine would give us the same boy still setting a back, and the leaper descending from his position in mid-air to his final position on the ground.

And now you may readily try this illusion, which is partly dependent upon the persistence of impressions. Take a piece of white cardboard, and draw a number of concentric black rings upon it, each being separated from its neighbours by a white ring of about the same thickness, so that the finished device ap-

pears as in Fig. 45. Now move the card rapidly before the eyes, and in this movement try and describe one small circle always, and the whole system of

concentric rings will appear to rotate on their common centre. This device is known as "Thompson's Strobic Circles." You may even try the experiment with Fig. 45, the only objection being the weight of the book, which will impede the rapid circular movement of your hands.

COLOUR-BLINDNESS.

This is a true story. Two of my friends, John and Harry, young fellows both, went along Knightsbridge one day to buy a couple of albums that they wanted to make presents of. John chose one with brown backs, and Harry determined, in his own mind, that he also would have a brown-backed album, and he accordingly selected a book of requisite size, form, and colour (so he thought). Now Harry was partly influenced in his picking a brown album by hearing his friend say how objectionable the green ones looked, and he walked home with no small satisfaction at the thought of being possessed of an object of a presentable colour.

Fig. 44.—THE PRAXINOSCOPE.

He was, therefore, not a little surprised when a chum of his asked him, a few days after, why he had bought such a dingy *green*-backed album. Murder will out, and so my friend Harry was obliged to confess that he could not tell *green* from *brown*, both colours being alike to him. Such people are said to be *colour-blind*.

Many eminent men have been colour-blind, and from one of these—Dalton, the famous chemist—colour-blindness has been named Daltonism. Delbœuf, a professor in the University of Liège, cannot tell the rosy-cheeked apples from the green leaves which surround them by their colour alone; and a certain distinguished professor we know, renowned for his chemical as well as physical researches, cannot tell which is which when a green solution of chromic chlorido and an orange solution of bichromate of potash are placed before him. They both seem to him of the same degree of darkness or shade when compared with a white surface or a colourless solution, and artificial means have to be adopted to discern that they are different. A pair of spectacles are taken with plain coloured glasses in them, and if one of these glasses be coloured, say blue, the colour-blind person finds that the shade or darkness of the orange solution is increased by looking at it through the blue glass, while the green solution seems to be comparatively unaltered when looked at in the same way. Colour-blind people appear to suffer no inconvenience from the defect save when they are employed where colours have to be distinguished, as in dyeing, and on the railways.

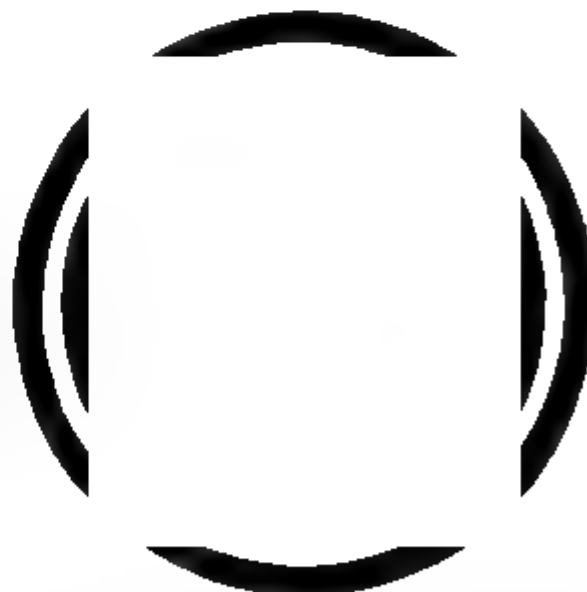


Fig. 45.—STROBIC CIRCLES.

THE COLOUR SENSE.

Now although we know that we have only five senses, we sometimes use such expressions as "the sense of heat," "the colour sense," &c., and if we rightly understand what is meant no confusion will arise, but rather a benefit, from their employment. For we see, in the first place, that the senses of touch and sight are referred to, but we are told more precisely by these expressions that we are dealing with touch as affected by heat, or with sight as affected by colour. For some years past there has been much guessing about the colour sense, in our curiosity to know whether the lower animals can distinguish colours as well as we, and whether our forefathers who lived ages upon ages ago could discern one colour from another as we do. As the outcome of these guesses at truth, we know that insects can tell one colour from another, and that animals high in the scale of life also know certain colours quite well, and seem to hate certain others, for if you have anything that is scarlet about you they will probably, like the turkey-cock and bull, make a rush at it. Now, so far as early man is concerned we have nothing to tell us whether he could tell one colour from another or not, except the words which we may dig out of ancient literature, and from which we derive lessons as from fossils. Homer, for example, who sang so much about the loves and hates of Trojans and Greeks, gives us only a few colour words, from which some would argue that he was colour-blind, and that possibly this was the universal condition of early man. On this supposition what a queer state the earliest hunters must have been in, *i.e.*, from our present standpoint, for everything would appear to them of one colour, so that a landscape, with its variegated foliage, blue ceiling, and green flooring, would appear to them just as a photograph appears to us: every outline perfect, but colour altogether absent.

Now all this is, of course, supposing that the ancients were colour-blind. But does it not seem probable, as some think, that the condition of these earliest hunters was similar to that of many a boy who may be reading this? When I was a lad I had not the slightest difficulty in telling a blue colour from a green colour, but I would sometimes make the mistake of calling green blue, or blue green. My eyes were perfectly right, but my list of colour words was only small, so that I sometimes employed *one* word for *two* colours. Now lads—and it is hardly flattering to say it—have a great deal of the early savage in them, and one of the main objects of their education is to get rid of this savageism. If, then, we may judge of savages in long ages past by the light of the behaviour of young savages ever present with us, it would seem very probable indeed that our earliest forefathers were not deficient in the colour sense, but rather that they had a lack of words to express all the variety of colours so richly displayed before them at sunrise and sunset, in the fresh tints of spring and the brown ones of autumn; and having only few words to name colours by, it is just possible that they might make *one* word do for two or many more colours. If we admit this, then it would appear that a landscape did not seem to them like a one-tinted photograph, but was rather a coloured panorama, varying with the hour of the day or the season of the year, and to some of them the sight may have been as gratifying as to us, their more highly-refined descendants.

WE ARE ALL BLIND!

Now this is rather a startling announcement, but it is quite true under certain circumstances, and applies to every one, even if he possess the keenness of vision of an eagle. It is a fact, moreover, which is easily proved, and you may try the experiment without even closing the book you are now reading. Here is a cross and a circle. Close the left eye, and regard the cross steadily with the

right one. Hold the page about a foot away, and you will see that while you are looking steadfastly at the cross your glance takes in the circle as well. Gradually move the page towards you, and now there comes a position, when the book is about eight inches from your face, in which, while you are gazing at the cross, you cannot at the same time see the circle. And what has happened? Simply this: that now the picture of the circle falls on a spot within the eye where it is powerless to produce the sensation of sight—blind, in short. And now if you turn the book upside down you may close the right eye, and make the experiment

X

O

with the open left eye, and you will then see that there is a spot in the left eye too which is blind; because upon looking at the cross again you come to a position as before, where the circle cannot be seen. Any one who tries this experiment, which is known as Mariotte's, will perceive that however good their sight they have a blind spot in each eye, and we may add that this blind spot is the place where the optic nerve enters in on its passage from the brain.

It is a remarkable fact that the blind spot in your right eye is on the nose or *left side*, while the blind spot of your left eye is placed on the nose or *right side*, an arrangement which is very admirable, as each eye in this way supplies the deficiency of the other.

REFLECTION OF LIGHT.

Substances which are not sources of light have the power to reflect it from their surfaces when it falls on them. Thus glass is a very good reflector; and the still surface of water is also exceedingly good in this respect, so that as you walk along the bank of a river its surface may appear like pearl by reflecting the white light of the clouds, and its margin greener than the emerald in mirroring the grassy slopes of the bank on the other side.

Now some of the light which enters our eyes has been reflected a great number of times. For example, when the sun is shining on the grassy slope we have just referred to, his light is sent on to the surface of the water, and if we are suitably

placed we see an image of it apparently below its surface. Here there are two reflections, the first from the grass and the second from the water. But if the sun had not been out, if his light had been obscured by clouds, we should probably have still seen the same green slope apparently many feet down, and it would this time have resulted from a great many more reflections than before, because the light of the sun, before reaching the grass, must have been sent from side to side by particles suspended in the air before reaching the grass. To commence with, let us study the case of a candle seen in a looking-glass.

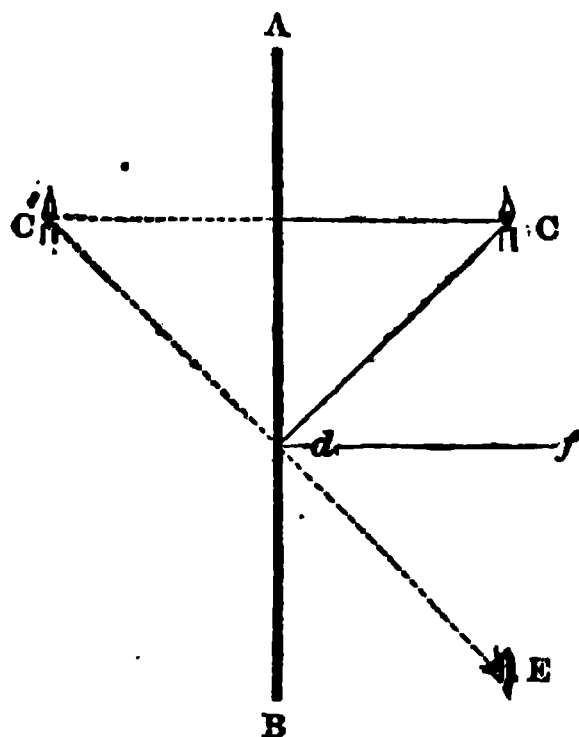


Fig. 46.—HOW AN IMAGE IS FORMED IN THE GLASS.

Place a looking-glass (A B) before you, and a candle (C) off one side (Fig. 46). In order to see the candle in the glass you will find that you have to place your eyes on the B side of the glass, say at E, and you now see a candle (C') as much behind the mirror apparently as C is before it.

And this image, which is reflected by the mirror at d, appears extremely real, so much so that if you bring a mirror before a kitten it will believe it sees a second kitten, until by repeatedly putting its paw behind it finds nothing there,

and then, if it be a wise kitten it will go away and have nothing more to do with it. From d , where the light is reflected, draw the line df at right angles to the surface of the mirror. The angle cdf , made by the light falling on the mirror, and the line df , is called *the angle of incidence*; and the angle edf , made by the reflected rays de and the line df , is called *the angle of reflection*.

The angle of incidence is equal to the angle of reflection; and it is of importance to note that we judge the image always to be somewhere in the direction of the reflected ray ed , as was the case in the reflection of sound (p. 415), so that the image of the candle appears behind the glass in the direction ed .

We are now in a position to consider a more complicated example—let us say the formation of the image of a boy in a large looking-glass (Fig. 47). The observer standing at c receives borrowed light proceeding from the points 1, 2, and 3, which is again reflected from the surface of the glass into his eye. As a result the observer at c perceives his very image at c' , each of the three points 1, 2, and 3, appearing behind the glass at $1'$, $2'$, and $3'$, and the same with all the points between and around which make up the object and image.

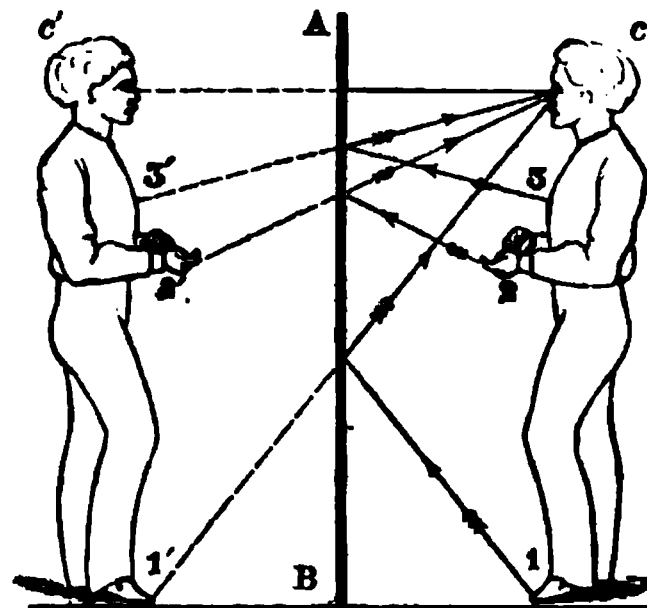


Fig. 47.—HOW YOU SEE YOURSELF IN A LARGE MIRROR.

A CURIOUS EFFECT OF REFLECTION.

If you take this book and turn any of its pages towards a looking-glass, you will find, upon attempting to read the reflected print, that you cannot do so at all. The word **MAGIC**, for example, appears as if it were **OIDAM**; and so with any other word, for they look just as they would if we could take each word and turn it completely over around one end as centre. This phenomenon is known as *lateral inversion*, and you really see it when you look at your image in the looking-glass, for the left side of your face appears really as the right side in the looking-glass, and so on. To see that it is so according to the ordinary laws of reflection is not difficult. Let AB be a looking-glass, and LR a line passing across the face from eye to eye (Fig. 48). Now, if the left eye (L) be closed, and the right eye (R) be open, it is plain from what we have already said of reflection that the left eye will appear at R' and the right eye at L' , and we shall have a face at $L'R'$ facing us; but in such a face looking towards AB it is evident that the open eye (L) will be to the left, and the closed eye (R) will be to the right, so that the image is laterally inverted.

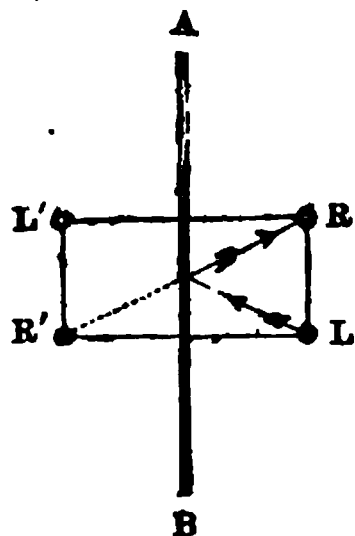


Fig. 48.—ONE'S FACE TURNED ROUND ABOUT.

PEPPER'S GHOST.

You would have to travel now for many a day to find an educated person who believes in ghosts. Time was, however, when you would have to travel quite as long to find some one who did not believe in them. There could then be found people who had seen them, so they thought, with their own eyes, and therefore were as much convinced of their reality as Hamlet was when he saw the ghost of his father at Elsinore. The belief still exists in unfrequented nooks of Great Britain, places where advanced ideas are a long time in reaching, and it exists alongside with a belief in

witchcraft and such-like nonsense. When a ghost appears nowadays, it is far from the busy haunts of men, and investigation—not always of the gentlest kind—has generally shown that the sheeted spectre has been made of solid flesh, much too solid to vanish or permit of a stout cudgel passing through it. By universal consent, then, ghosts are now relegated to the stage. How real they appear there probably every lad is aware, for has he not seen them in white flowing robes, walking along and speaking, and exhibiting the ghostly attribute of permitting a performer to run his sword through them without their being in the least affected? For many a day after he has doubtless wondered how the thing was done, and has at last given it up in despair, while all the time the explanation was to be had without stepping out of doors even, so very easy to understand are some of these things.

Often, when you have been rain-bound and stood gazing out of the window, you have seen, as if outside, a fire less vivid, but the exact picture of the fire within the room. The *ghost* of the fire, it is plain at once to see, results from the transparent pane of glass just opposite you acting as a reflector. Pepper's ghost is produced just in the same way.

A large plate of transparent glass on the stage faces the audience, being inclined at an angle of 45° . Below this the actor stands in a pit, with a strong light falling on him. The audience cannot see him, but his image as reflected from the glass is very apparent, and seems to be on the stage and somewhere behind the transparent reflector, so that in gazing steadfastly at the ghost you fail to perceive the glass which produces it. Ghosts produced in this way are often shown in the travelling shows, but you will have no difficulty in detecting the large plate of glass on the stage now that your attention is directed to it.

THE HELIOGRAPH: TELEGRAPHING BY SUNLIGHT.

Often during the campaigns in Zululand and Afghanistan a peculiar mode of transmitting news was adopted when the telegraph-lines had been cut by the enemy, or where no telegraph-lines had been erected. The plan is so exceedingly simple that you will understand it at once. You have often noticed that the window-panes of houses miles away have looked like burnished gold; it has happened at such times that they were so placed with reference to the sun and yourself that the light from the great luminary has been reflected from them straight in your direction. A single bit of looking-glass placed in the same plane as these windows would have acted just in the same way. Now suppose you have a comrade on a distant hill, with a piece of looking-glass so placed that the light of the sun or moon is sent in your direction, you could see the flare a great many miles away, and each time he brought his cap before it the bright point would disappear. If, therefore, you have arranged with your friend that a certain number of times of taking his cap away from the mirror—i.e., of producing a given number of flashes—shall mean a certain thing, he is able to communicate with you; and if you have a mirror too, you may communicate with him, and so hold a conversation.

Often in this way has one camp flashed news to another over the heads of their common enemies, and the line of communication could not be cut, as would have been the case had the two camps been connected by ordinary telegraph. Here, then, we see one of the most elementary principles in Physics employed for a very important purpose.

In practising the simple experiment we have described, you would find certain practical difficulties, such as directing reflected light just where your friend happened to be stationed, and keeping it turned there, and the like. The field heliograph is constructed so as to obviate these difficulties. In Fig. 49, *a* is the signalling-

mirror, and *p* a screen for obscuring it, which therefore answers to your comrade's cap; *c* is a slow-motion screw for vertical adjustments, and *g* a horizontal bar, with cross-wires (*k*) at one end. In getting ready for signalling, the observer looks through a hole (*b*) in the mirror, while an assistant adjusts the cross-wire frame (*k*), until the middle of the cross-wires and the distant place appear to be in the same line with his eye at *b*. The arm and wire frame are now fastened by means of screws. A white disc is next placed in the centre of the cross-wires, and a black one in the hole of the mirror at *b*. If the sun's light reflected from *a* were now thrown on to a screen close at hand, a black dot would be seen on it, this portion of light having been absorbed by the black disc. The screws of the signalling-mirror are now turned until it sends this shadow of the black disc on to the white one in the middle of the cross-wires, and you will now perceive that the sun's rays proceed in the required direction (*l x*). When the position of the sun is such as to render it difficult to reflect the rays from *a* in the direction *l x*, a second mirror (*r*) is employed to send them on to *a*. And now with the screen (*p*) in position to intercept the rays from *a*, everything is ready to flash signals to the distant camp; a sapper, therefore, stands by the screen (*p*), and employs the key (*d*) for signalling, just as you would your cap.

Fig. 49.—A MILITARY HELIOGRAPH.

REFLECTION OF LIGHT WITHIN WATER.

It is a curious fact that sometimes light after passing into water cannot pass out again from the surface. You may see this in the following way:—Fill a flask (*b*) half full of water, and place it at the end of a table (Fig. 50). A

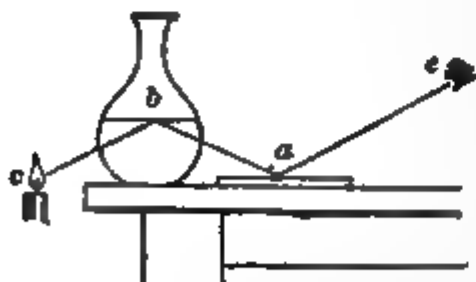


Fig. 50.—REFLECTION OF LIGHT WITHIN WATER.

candle may be now placed at *c*, and the eye at *e* will not see the flame because of the flask intercepting a view of it, although one would have thought that the light proceeding from the candle in the direction *c b* would have come out at the surface of the water on its way forward to the eye. Not so, however, for light from the candle cannot penetrate the surface at this particular angle, and is reflected in the direction *b a*, so that if you want to see it with your eye still at *e*, you have to place a looking-glass at *a* to reflect the light again towards you. Reflection within the liquid at *b* is called total internal reflection, and the experiment you have now done will help you to understand that strange appearance known as *mirage*.

STRANGE AERIAL SIGHTS THAT HAVE BEEN SEEN.

Many years ago the good ship *Baffin* (Captain Scoresby) was sailing in the Arctic regions. The heat of the June sun was perceptible even in that icy quarter, softening the tar in the rigging of the ship, melting the snow on the

surrounding ice, and making things generally more cheery than they are wont to be in those desolate places. This weather had the same effect on the bears that it has on folk at home, because they turned out in great numbers as if for enjoyment, while the whales were seen disporting themselves in places where the ice left sufficient room for them to roll about. At about six in the evening the crew saw, upon looking in a north-westerly direction, the ships ten or fifteen miles off begin to change their form and magnitude. One of them appeared to have another nicely balanced at its mast-head, and turned upside down, and in

Fig. 51.—MIRAGE EFFECTS SEEN BY CAPTAIN SCORESBY.

many of the other cases the ships seemed to have others above them in inverted positions (Fig. 51).

In a later voyage to the coast of Greenland, Captain Scoresby having seen an inverted image of a ship in the air turned his telescope towards it, and at once identified it as his father's ship, the *Fame*. So it subsequently turned out to be, though it was nearly thirty miles away at the time. These were effects of mirage.

Now turn to the experiment described in the preceding paragraph. An eye placed at *a* (Fig. 50) would see an image of the candle. So likewise (Fig. 52), in these mirage effects the layer of air (*A A'*) being hotter, and consequently lighter, than the layer at *B B'*, the surface between them would not permit the light from the ship to pass through; but light coming, say, from *c* was reflected at *b* down towards the observer at *a*, and would consequently appear somewhere in the direction of the line *a b c'*. In the same manner would other portions of the light from the ship be reflected, giving rise to the inverted image *c'*.

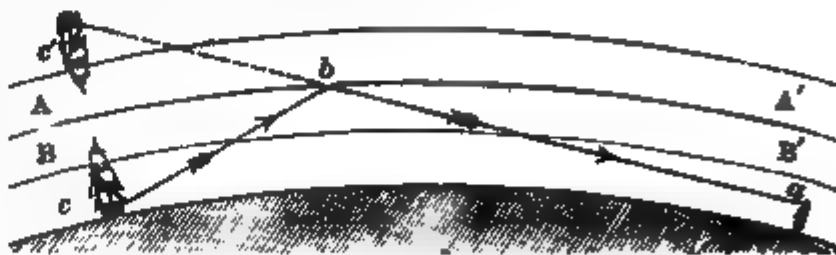


Fig. 52.—WHY THE SHIPS WERE SEEN UPSIDE-DOWN IN THE AIR.

The same phenomenon has often tantalised weary and thirsty travellers in the desert. They have seen what has seemed to them the much wished-for water, reflecting from its cool surface the images of objects close by, and as they have travelled towards it it has gradually vanished into thin air, thus intensifying their despair. The images produced have looked so real that the beholders have readily been deceived.

We shall now describe a couple of instruments producing effects amusing and instructive, which depend upon reflection. Both may easily be made for a mere trifle, and when made will be very entertaining, especially to youngsters.

HOW TO MAKE A MULTIPLE IMAGE APPARATUS.

Procure two oblong pieces of plain glass mirror, four inches long and say three inches wide (Fig. 53). A piece of paper must be pasted to the backs of each, so that they will open and shut like the leaves of a book. We now want a piece of deal about eight inches long and four inches wide. On this there must be pasted a sheet of paper with a graduated semicircle, reading, say, to 10° . At the centre of the circle of which this semicircle is part, drive in a stout wire, so that it stands upright. The paper hinge of the two glass mirrors is made to embrace this wire, so that the glasses may be fixed at any required angle to each other. Now take an object, say a button, and place it between the two mirrors, at an angle of 120° to each other. Count the number of buttons which you appear to see. There are three.

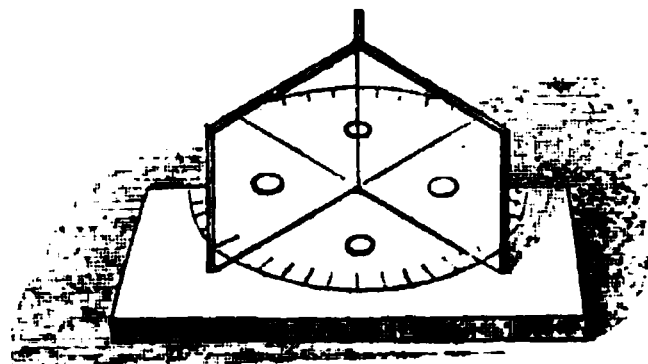
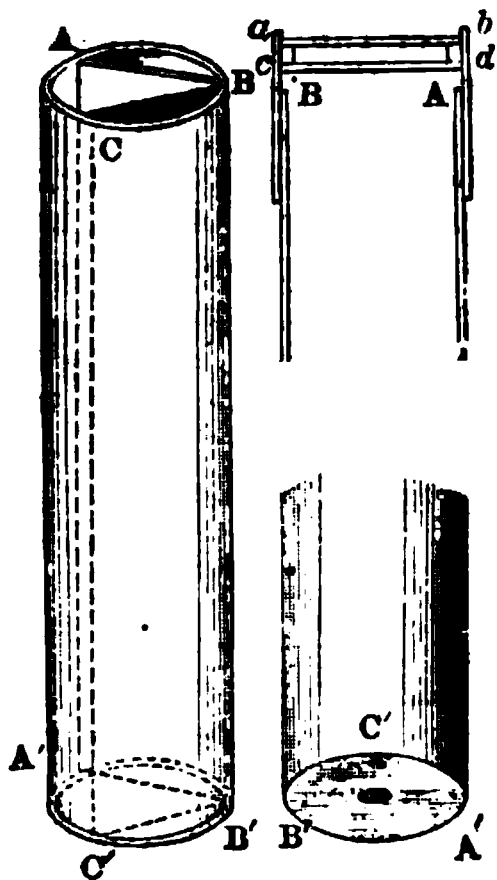


FIG. 53.—MULTIPLE IMAGE APPARATUS.

If you know the angle at which the two mirrors are inclined, it is easy to tell how many images will be seen. You proceed as follows:—Observe the number of degrees at which the two mirrors are inclined, and see how many times this number is contained in 360. Now subtract one. The number obtained after subtraction gives the number of images that will be seen. Thus, suppose the angle at which the mirrors are inclined is 45° ; $360 \div 45 = 8$, and after subtracting 1, we have the number 7. Upon inclining the mirrors at 45° , seven images will be counted, if the button or other object be placed between them.

It has been supposed that by reflection of this kind the apparent number of the stars is increased, and upon it is based that very beautiful invention known as the kaleidoscope, due to Sir David Brewster.



FIGS. 54, 55.—HOW TO MAKE A KALEIDOSCOPE.

THE KALEIDOSCOPE, AND HOW TO MAKE IT.

Probably two of the greatest sources of pleasure to the eye are symmetry of form and beauty of colouring; any object combining in itself these two qualities is certainly a thing of beauty and a joy for ever. Our love of colour we display from childhood upwards, and our craving after symmetry of form we show in the commonest affairs of life, for are not all our articles of furniture so made that, if you split them fairly in two, one half will closely resemble the other? And in our arrangement of ornaments, do we not take care that the glass vase with pendent lustres at one end of the mantelpiece shall have a companion vase at the other end precisely like it in form, dimensions, and colour? It is, therefore, not surprising that when Sir David Brewster had invented the kaleidoscope, an instrument which displays to us an endless variety of symmetrical form and beautiful colouring, it is not surprising, we

say, that 200,000 instruments were sold in London and Paris alone in the short space of three months.

This is how to make it:—Procure two pieces of glass about eight inches long and one to two inches wide. Paint one surface of each with black paint, and then

place the two plates inside a paper tube, as in Fig. 54, with their unpainted sides facing each other. An object-box may now be constructed by having a piece of paper tubing fitting on to one end—A, B, C—like a pill-box lid, only, instead of having a circular paper end, it must have a circular glass end (*a b*, Fig. 55). Fitting closely to this have a paper ring, to separate *a b* from a similar plate of glass (*c d*); in this way a circular box will have been made of sufficient depth to permit of its containing bits of coloured glass, beads, and such-like things. At the other end (*A', B', C'*) a circular piece of cardboard is fitted with a round hole in the centre for you to peep in at. As you look in it, you will see a pattern of great symmetry (Fig. 56), and you may alter the design every time you turn the object-box round.

AN INVISIBLE COIN MADE VISIBLE.

This is an exceedingly simple experiment. Put a coin, say a penny, at the bottom of a basin, and now lower your eyes until you cannot see it for the edge of the basin. If you now fill the basin with water, the coin will re-appear.

It is evident that the coin has not been seen through the side of the basin, for we appear, as we see it in the new position, to be looking over the top of the side. Thus, if a coin be placed in the vessel at *c* (Fig. 57), an eye placed at *e* cannot see it for the edge; but when the basin is filled with water the penny appears at *f*; join *f* and *e*. Now this is certain, that the light from the penny emerges from the water at *b*, and, moreover, although the penny appears at *f*, the light sent from it proceeds from *c* in the straight line (*c b*). Therefore the path of the rays from it is bent at *b*, and takes the direction *b e*; and in virtue of the law that we always think a thing in the direction whence the light comes, the coin appears, when water is in the vessel, to be somewhere in the direction of *e b*—i.e., at *f*. Light here has plainly been bent, or, to use the scientific word, *refracted*, which means the same thing.

You will, no doubt, have often noticed the same phenomenon when you have been boating, for as you have looked at your companion's ears they have seemed bent just where they dipped into the water; or you may see it at any time by taking a tumbler full of water, and dipping a spoon into it. Upon looking in a slanting direction, you will see the apparent bend in the handle of the spoon, and upon looking horizontally at it, the upper portion of the spoon will appear completely severed from the lower.

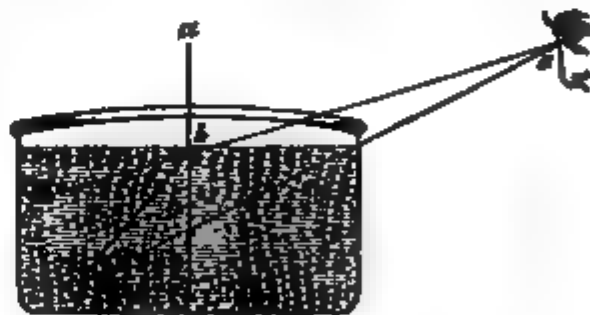


Fig. 57.—AN INVISIBLE COIN MADE VISIBLE.

EXPERIMENTS WITH A DOUBLE CONVEX LENS.

If you examine an ordinary magnifying glass, you will find that it bulges out on each side, or it is convex on each side, so that we term such a lens a double

convex lens. The spectacle glasses used by old people are generally lenses of the kind, only the bulging out is so small that you might not notice it if your attention were not called to it. The crystalline lens is also a double convex lens, and an extreme case of a double convex lens is presented to us in a plain carafe filled with water. Now, one of these double convex lenses (Fig. 58, a), if cut fairly in two, would present us with a section which you will perceive is not unlike a couple of prisms placed base to base.

For an experiment or two you may now try, you will require a screen, which may be a sheet of white writing-paper; or, if you prefer to be more elaborate, take a small piece of tracing-paper, and paste it around two upright sticks fastened into a flat piece of wood. Now get a candle and a double convex lens, which may be either a flask filled with water, a spectacle-glass devised for long sight, or an ordinary magnifying-glass. Fix the double convex lens, and place the candle a foot or so away, and on the other side of the lens adjust the screen at such a distance that an image of the candle is formed on it. The place where the image is formed is called the focus. You will observe that the farther you take the candle away, the nearer the focus comes to the lens, until at last it nearly corresponds with the focus obtained when the sun is substituted for the candle, and a round image of the sun is cast upon the screen. The focus obtained when the sun's image is cast upon the screen is called the principal focus, for all parallel rays falling upon a double convex lens of this kind are brought to this principal focus to form an image.

You will also notice what is a very curious thing (Fig. 59), that the image (IV) is upside-down. The picture the crystalline lens casts on to the back of the eye, or retina (p. 426), is also inverted, or upside-down; but we have been so used to this from earliest infancy, before we could reason at all, that we were educated by our experience to recognise high and low as they are; for when we bumped our heads against anything, although the image of that thing might be on the lower side of our retinae, we were taught to call it high, because it hurt one of the highest portions of our body, and so on.

In such lenses as we have described, two things are to be noticed, and these are defects. (1) That the lens acts like prisms, base to base, and to some extent decomposes the light passing through it, so that if you place a screen in the way of the light before the focus is reached, and likewise after, you will have the light of the sun surrounded by a coloured rim in each case; (2) That the image formed is not perfect in form, being, especially when a water-flask is used, very much blurred in outline.

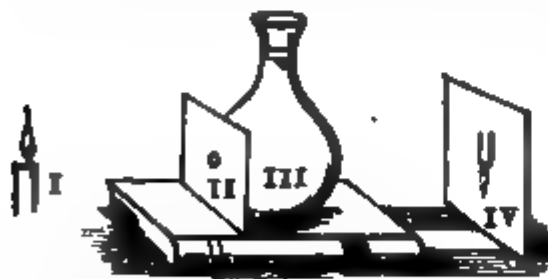


Fig. 58.—HOW IMAGES ARE FORMED BY LENSES.

Now both of these defects may be removed to a large extent by employing a sort of ring-screen (II), to cut off the outside rays before they enter the lens (III). You will notice an improvement at once in the image on the screen if you admit the light on to the flask through a circular hole in a sheet of cardboard.

It is supposed that the iris, or coloured curtain of the eye, is a ring-screen of this sort, designed to improve the general outline, &c., of the image cast on the retina, and to remove those coloured marginal rays we have spoken of.

Fig. 59.—COMPARISON BETWEEN LENS AND PRISM.

And now we shall describe how to make that very pleasing instrument known as the *camera obscura*, for we have already learnt sufficient about reflection and refraction to enable us to understand it thoroughly.

THE CAMERA OBSCURA.

In making a camera obscura the first thing we want to know is the focal length of the lens we are going to employ, as upon this will depend the size of the box we have to use. The length of the box

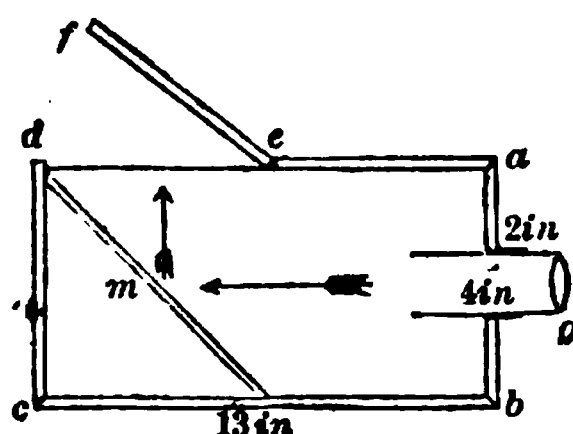


Fig. 60.—CAMERA OBSCURA.

has to be rather less than the focal length of our lens. Thus, if the focal length of our lens for objects some yards off be say fifteen inches, we may make our box thirteen inches long and about eight inches deep, and eight inches wide. A round hole must be made into one end (*a b*), just sufficiently large to allow the tube containing a double convex lens to work backwards and forwards smoothly (Fig. 60). A mirror (*m*) is fixed at the other end, at an angle of 45° , so that it reflects all light coming from the round hole

upwards in the direction of the arrow. One portion of the side (*a d*) is made into a door (*e f*), turning on hinges at *e*. At *e d* a square plate of ground glass or smooth glass may be placed, just as required. And now as to the double convex lens. A paper tube may be made of such a diameter as to hold it at one end, and in passing we may say that such paper tubes are very readily made by rolling the paper round a wooden cylinder of requisite diameter, and, as each turn of paper is wound on, gumming it well down. When the gum is dry a good tube is procured. Around the paper tube that has been made another may now be wound, about two inches long, and this will have to be fixed to the hole at the end of the box (*a b*), so that the tube of lesser diameter containing the lens may slide backwards and forwards. Paint the inside of the box black, and of the tubes too.

And now, if everything be in order, we may proceed to work with our camera. The ground glass is fixed at *e d*; the lens at *g*, focussed for the external street or landscape, and we now find them pictured on the ground glass in form and colour marvellously like the scene without.

If we wish to make a drawing, the ground glass must be replaced by a sheet of clear glass, and on this tracing paper may then be fastened down, and with a sharp pencil point the outlines of the picture are now readily drawn.

The camera obscura has been employed for warlike as well as gentle purposes; and it was used in this way on the occasion of the defence of Venice in 1859. The Austrians who held the city were afraid that the Italians might suddenly come upon them, and part of their defensive measures was the erection of a large camera obscura (Fig. 61). You will perceive from the figure that this camera when built was not unlike the one you have perhaps now made, for there is a double convex lens (*b*) at one end of it, and at the other a screen (*c*) in the shape

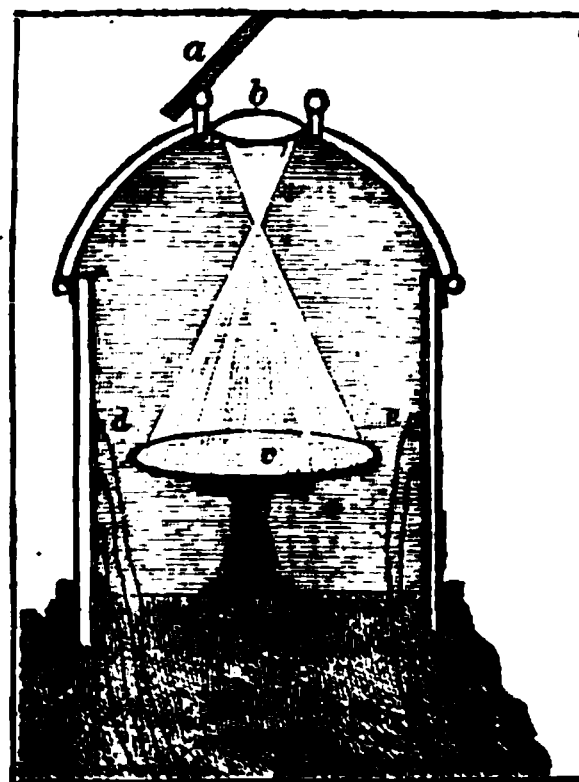


Fig. 61.—A CAMERA USED FOR WAR PURPOSES.

of a table with a white top. The Venetian camera was built on a rock overlooking the harbour, so that by means of a looking-glass at *a* a beautiful picture of it was cast on to the table, and it is apparent that a person standing by the table could see the movements of all vessels, whether of peace or of war, that came towards the city. Torpedoes were now sunk in the harbour, and the point where each numbered torpedo was sunk was marked on the table. Torpedoes, as you may be aware, are fired by means of wires leading from them to the shore, and in this case to the inside of the camera (*d*, *e*); hence at the end of the operation torpedoes had been planted in different parts of the harbour, and the soldier within the camera could tell exactly where each one was, and which wires communicated with it, so that he had it in his power, while watching the picture on the table, to blow up any Italian ship that might come near one of the sunken torpedoes.

Another instrument only requiring a knowledge of refraction to understand it, is the *Spectroscope*.

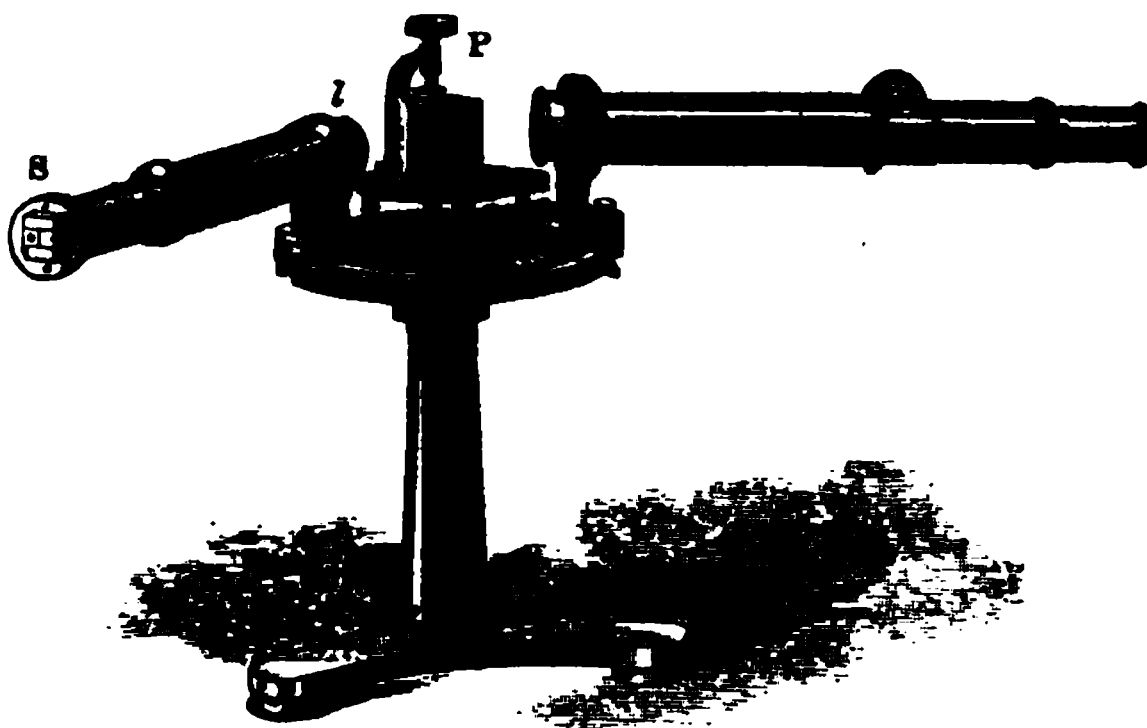


Fig. 62.—THE SPECTROSCOPE.

THE SPECTROSCOPE.

It is possible for the chemist to tell you what there is in a substance when you give him a piece of it to analyse. He takes it, and subjects it to all kinds of processes, and in the end learns all he wants to know about it. Now, you will perceive that for him to analyse it he must handle it—if not with his hands, at least with the implements in his laboratory; and so necessary is this that not very many years ago you would have been told that it was impossible to analyse the sun and stars, because we could get no samples from them to test. The thing has been done, however, by means of the spectroscope (Fig. 62). Now, this instrument is so interesting on this and other accounts that we shall do well now to acquire the knowledge necessary to understand it, and for your encouragement we may say that, complex as it looks in Fig. 62, you may readily understand it. Let us, therefore, learn something, in the first place, about the prism *P*.

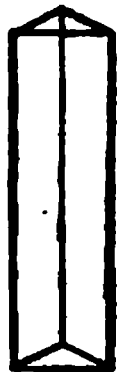


Fig. 63.—
A GLASS
PRISM.

EXPERIMENTS WITH A PRISM OF GLASS.

A prism of glass (Fig. 63), may be procured for a few coppers, and cheap and simple as it may seem, it proved a powerful instrument for discovery in the hands of a Cambridge student more than two hundred years ago. It was all about the time when everybody was so frightened with the plague which Daniel Defoe has most vividly described—when Londoners were flying into the country to escape it, and country people were hurrying they knew not whither to get out of its reach—that Newton was pondering over the behaviour of light in passing through such a prism. And this Mr. Newton, afterwards Sir Isaac, obtained some very

interesting results from exceedingly simple and inexpensive experiments, showing as, as the annals of science show us often, that great discoveries may sometimes be made with what most people would regard as toys.

Take your prism now, and look at a candle flame through it. The candle flame seems all rainbow colours, and you can easily make out red, green, blue, and violet, which appear very vivid indeed. A change, then, has been wrought in the candle-light while passing through the prism, and the nature of this change is seen most simply in repeating one of Newton's experiments.

A ray of light was admitted into a dark room by means of a hole in the shutter; this ray, as you already know (p. 429), would pass straighter than an arrow to the opposite side of the room. A prism was now placed in the path of the beam, and after this it no longer proceeded in a straight line, but was turned on one side, spread out into a fan-shaped ray, and a patch of rainbow was cast on the opposite wall. Precise ideas regarding this experiment may be obtained

from Fig. 64. A sunbeam (s) then passes into a dark room, taking the direction A K; but a prism (P) is placed in its path, and now the ray is turned aside, spread out, and cast on the opposite wall in a rainbow ribbon (H I). If you repeat this experiment you will observe this order of colours—red, orange, yellow, green, blue, indigo, and violet. You will not be able to tell where one colour ends and another begins, for they merge into each other imperceptibly, but generally speaking one may easily dis-

Fig. 64.—A RAY OF WHITE LIGHT BROKEN UP.

tinguish the seven colours of the rainbow. The coloured band of light (H I, Fig. 64) which is thrown on to the wall is called a *spectrum*.

You will observe that to form a spectrum the rays of light are very much bent from their first course (A K), and that of all these rays red are least bent and violet most so. You will further observe that white light by its passage through the prism has been split up as it were into a number of coloured lights, from red to violet. These observations teach us, as they taught Newton, that white light consists, roughly speaking, of seven kinds—red, orange, yellow, green, blue, indigo, and violet lights; and that when white light passes through a prism it is broken up into its component parts on account of these coloured lights differing in bendableness or *refrangibility*.

When we have grasped these facts it is easy to see that they lead to a ready explanation of the colours of bodies; for if a substance be *blue*, we may suppose that when white light falls on its surface all the portions of the light are drunk in or *absorbed*, and only blue light sent back to the eye. Such a simple explanation would do for most coloured bodies.

HOW TO MAKE A SPECTROSCOPE.

The prism.—Take a piece of glass tubing, about one inch in diameter and an inch and a half long. The tube may now be reduced to something like the following shape (Fig. 65), by prising off small pieces of glass at a time from each

end with the wards of a small key. Procure some emery paper and turpentine, and now the rough surfaces of the tube may be worn down, by rubbing it on



Fig. 65. - FIRST STAGE IN MAKING A PRISM.

the emery paper after its surface has been wet with turpentine. This rubbing down must be continued until the edges of the tube are inclined to each other at an angle of 60° . Drill a hole into one side of the tube by means of the point of a hard file (Fig. 66). Now dissolve a little glue in hot water and add a few drops of glycerine, and with this cement



Fig. 66. - SECOND STAGE IN MAKING A PRISM.

two small squares of glass to the ends of the tube. When the glue has hardened we possess a kind of glass box with a small hole for its only opening. Fill it now with disulphide of carbon. Upon now pasting a bit of paper over the round hole we obtain a very good prism (Fig. 67).

A fairly good prism may be made out of a lustre. Take one of these glass pendants, and having decided into what lengths you would like to break it, nick it with a file around the parts where you want it to split, as if it were at the dotted portion of Fig. 68, A. You may now break it, by having it resting on two boards, as at Fig. 68, B, and giving it a smart knock.

Although the prism we have now obtained seems right enough, its surfaces



Fig. 67. - FINISHED GLASS PRISM.

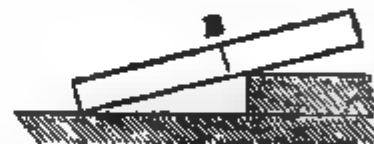


Fig. 68. - HOW TO MAKE A PRISM OUT OF A LUSTRE.

are but imperfectly polished, and this would prevent us from seeing spectral lines with the requisite definition, but it does not very materially affect absorption spectra, because of the shortness of the spectrum it gives.

The lustre prism may now be mounted in a tin stand made specially for it, either by yourself or the tinner (Fig. 69).

If you want to make a large disulphide of carbon prism, say about three inches deep, the following will be as handy a method as possible. Get the tinner



Fig. 69. STAND FOR LUSTRE PRISM.

to make you a tin box of prism shape (Fig. 70) with two of its tin sides, $a c$ and $b d$, at an angle of 60° , and with round holes in them. You now take two pieces of glass, ordinary window pane, of just a little less area than one of the sides, and these are each passed into the box in turn. One edge of the plate of glass being thrust up to $a d$, the other end is now brought round, describing a curve, and the plate of glass now fits flat to the tin, and adheres because of the glue which has just previously been applied. In making the tin box the tinner must be careful for this reason to make the side $b c$ curved, an arc of a circle with radius $a c$ or $a b$. The remaining glass plate



Fig. 70. - A LARGE PRISM.

may now be fitted to the side *b d*, and then your box is fit to take to the tinner again, to have a lid soldered on the top, with a small hole in it for filling the box with disulphide of carbon, and this hole must have a screw in it, so that the screw stopper may afterwards be made air-tight to prevent the evaporation of disulphide.

The slit (Fig. 71).—Procure two pieces of brass plate, and cut into corresponding semicircles. Make their straight sides as smooth as possible, by



Fig. 71.—MAKING THE SLIT.

filing with a very smooth file, and then wrapping the file in some fine emery cloth and rubbing perfectly smooth with this (a). Make another plate circular



Fig. 72.—COLLIMATING TUBE.

lar (b) with a square opening in the middle of the length of the required slit, and on this plate rivet the two brass semicircles, as in Fig. 71, c, so that the finest slit possible is seen when they are held up to the light. If, however, you prefer to have a slit of the ordinary type, you may, if you possess skill enough, attempt to make one with the sliding shutter arrangement, as at s, Fig. 62.

Perhaps the simplest way of all is to take a circular plate of brass, of the same diameter as the tube it has to be fitted to, and rule a straight line along its diameter. This straight line is now graven into by means of the fine point of a file until it is nearly worn through, and now the slit may

a

Fig. 73.—HOME-MADE SPECTROSCOPE.

The collimating tube (Fig. 72).—Procure a double convex lens of about a foot, or rather less, focus. It may be the glass out of an old pair of spectacles. A paper tube must now be made, of rather less than the focal length, and of the

same diameter as the lens. Prepare another tube to fit into this one, like a sword into its sheath, and about two or three inches long. At the end of this latter the slit piece has to be fixed. The inside of each tube must now be painted black, so that all light falling on its sides may be absorbed. A very good paint for the purpose is a mixture of lamp black and alcohol.

And now you have all the materials for building your instrument. First take a piece of deal nine inches long, four inches broad, and three-quarters of an inch thick; this will answer for the stand. And now the collimating tube (*c*, Fig. 73) is fixed on to it with bands of tin, tacked down at each end. The slit is at the end (*a b*), and is seen below in front view. The prism is now placed at the lens end of the tube, and if not high enough a paper stand is made of the requisite thickness and placed under it, as *d*. If now the flame of a candle be placed at *a b*, with the slit upright, the spectrum of the light will be seen upon looking into the prism with the eye at *e*. It will be seen that extraneous light, however, very much mars the effect, so that the prism and lens must be covered with a black cloth, or what is better, a groove (*e f g*) must be made, surrounding the prism and lens. And now a cardboard box must be made, and well blackened inside. It must fit neatly into the groove, and have a hole just above *e* for the eye to spy into, and a tunnel just above the lens, so that when fixed in the groove it fits nicely over the lens. Its form is shown in Fig. 74. The instrument is now completed, and if made according to our instructions it will be one the reader may be proud of, for it will show the Fraunhofer lines, absorption bands, and bright lines of coloured flames.

Fig. 74.—COVERING-BOX.

If you want to magnify your spectrum you may clamp down at *e* an ordinary tourist's telescope, or one made according to the directions given on p. 464.

HOW TO MAKE CELLS FOR COLOURED SOLUTIONS.

In examining coloured solutions with the spectroscope it is inconvenient to have the liquid in drinking glasses, bottles, and vessels of this kind; we require



Fig. 75.—CELL FOR COLOURED SOLUTIONS.

rather vessels whose glass sides are parallel, so that light can pass through them straight into the spectroscope. For making vessels of this sort the following is about the simplest way of proceeding. Suppose you want a cell half an inch thick; you procure a piece of deal rather over half an inch in thickness, and cut out of it a half elliptical piece (Fig 75). Small square plates of glass are now procured, large enough to cover the

opening on each side, so as to form a vessel with parallel glass sides. The wood is chiselled out on each side, so that the glass pane may be neatly let in, and afterwards fastened with putty or glue. A set of cells of this sort will be found very handy.

EXAMINATION OF ABSORPTION SPECTRA.

And now, to examine coloured solutions with the spectroscope, you take the coloured solution—say, for example, beer—and fill the cell with it. A candle is placed in front of the upright slit of the spectroscope, so that you can see

a continuous band of light extending from red to violet, and the cell of coloured solution is next placed in front of the slit so that the candle light has to pass through it before reaching the interior of the instrument. In beer, and yellow solutions generally, you will find that the violet to blue light cannot pass through them, and when the solution is strong you may have, also, the green absorbed, so that the spectrum of such a solution would consist of only a continuous band of yellow, orange, and red light. There are some other substances, as, *e.g.*, blood, and weak solutions of the aniline dyes, which give dark bands in the middle and at right angles to the length of the spectrum, and by these bands they may generally be told.

DIFFERENT KINDS OF LIGHT AS EXAMINED BY THE SPECTROSCOPE.

You will find great differences in the nature of light emitted by various sources, for they do not all give continuous spectra like the candle. If you examine the light of the sun, for example, with a very narrow upright slit, you will perceive a multitude of thin dark lines crossing the spectrum parallel to the upright



FIG. 76.—THE SOLAR SPECTRUM.

slit (Fig. 76). These dark lines are known as Fraunhofer's lines, and they tell us a strange tale about the composition of the sun, of which more anon. A paraffin oil lamp will give a continuous spectrum like the candle, but its spectrum is richer in the light at the violet end than that of the candle is. From which you will see that we have the explanation, here, of the fact we observed with regard to the shadows each of these lights illuminated (p. 431). You will remember that the shadow illuminated by the candle was yellower than that illuminated by the paraffin oil lamp, and this arose, as you will now see, from the latter being richer in rays at the violet end of the spectrum, rays which would prevent any yellowness from being visible in its light.

If you were now to take the flame of a spirit lamp and salt the wick, you would observe, upon examining the yellow flame with the spectroscope, a single bright yellow band. This yellow line is characteristic of the metal sodium. Another very beautiful flame, when examined in the spectroscope, is that produced by putting a compound of strontium in the flame. To the eye, the flame appears crimson, but in the spectroscope you see half-a-dozen red bands, one orange, and a beautiful blue band.

In obtaining these spectra, you will find it necessary to have a loop of platinum, to which you may fix a handle of glass tubing by sealing one end of the wire (Fig. 77) into it; and as you require your spectra, you dip the loop into the particular solution you want to examine, and then bring it into the flame. You will find by experience that it is necessary always to clean the wire before trying a fresh solution; for if you do not, you get not only the spectrum of the new substance you are

trying, but also that you were last examining mixed up with it. To clean the wire you may heat it repeatedly in the flame, dipping it every few seconds into hydrochloric acid, which you may have in a watch-glass by you. When clean it will not colour the flame.

These bright lines are very characteristic of substances, so that when you see

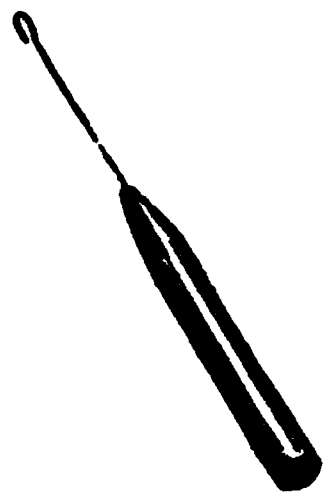


FIG. 77.—PLATINUM WIRE FUSED INTO GLASS-TUBE.

the bright yellow line we have referred to you may be sure you have a compound of sodium in the flame, or if you see the particular blue line you may know that strontium is there. When, therefore, the spectroscope was a comparatively new instrument there were a great many observers using it to see whether they could obtain new lines, for such new lines they supposed would point out the existence of hitherto unknown elements. In this way Crookes found a substance which gave a beautiful green line when its flame was examined in the spectroscope, and a new element was discovered which is now known as thallium. Several elements have been discovered in the same way abroad.

DARK LINES IN THE SOLAR SPECTRUM.

You will be anxious to know what is the meaning of those dark lines in the sun's spectrum, so that a few words on this subject will be of interest. Each of these dark lines is found to correspond exactly with the bright lines obtained in the examination of coloured flames. For example, a particular dark line in the sun's spectrum which you will see with your spectroscope in the yellow, corresponds completely with the yellow line you obtained in examining the salted wick of the spirit-lamp. Now, this is a curious coincidence, and one which obviously means something, and its meaning becomes evident in the face of the following fact:—When the bright white light from an oxyhydrogen lamp is made to pass through a flame coloured yellow by the presence of sodium (the metal in common salt) it is now found that in the spectrum there is a *dark* line corresponding to the particular dark line in the solar spectrum. Now, to produce this artificial dark line we have a fiercely hot oxyhydrogen flame impinging upon a solid piece of lime, and we have a yellow flame not so hot; may it not be, then, that we have in the sun a fiercely hot ball sending out light like the oxyhydrogen arrangement, with a cooler atmosphere around it acting like a sodium flame? If we suppose this for an instant, then it follows, from the presence of the particular dark line in the solar spectrum which we have been studying, that there is sodium in the atmosphere of the sun!

Now, this is only one of a host of facts which scientific men have studied, all tending to show that the sun is surrounded by an exceedingly hot absorbing atmosphere, and by studying these dark lines in the spectrum, and carefully comparing them with bright lines you may obtain with substances here on earth, we have gained some insight into the composition of the sun. This meaning of the dark lines in the sun's spectrum was discovered by two German philosophers, Kirchhoff and Bunsen.

THE RAINBOW.

Rainbows may be seen under very different circumstances, but wherever or however seen there must be a light like the sun, and a shower of water-drops; and you must be in a certain position with respect to the light and water-drops, for in no other position can you see a coloured bow. That this is the case you will see by recalling to mind the various times and circumstances when you have observed rainbows.

A company of firemen were practising working their hose, &c., and directing a jet of water on to the side of a large building. The stream of water hurled high into the air was separated into ten thousand drops, and while you were watching the descending spray with your back turned to the sun, you saw a portion of a rainbow with one end on the floor and the other against the building.

You will remember that once you were out for a walk in a public park when the flowers were in full bloom and the sun was brightly shining, and as you took a turn around the fountain admiring the arrangement of the jets and watching

the glistening drops describing graceful curves on their way back to the water, you came to one spot where it was possible to see a portion of a rainbow with one end resting on the water and the other vanishing in the air. At this spot your shadow pointed towards the fragmentary bow; in other words, your back was again turned to the sun.

Do I hear you say you never saw these things? Well, look next time you are placed as I have described, and then you will be sure to see them. You have, however, seen a regular rainbow formed by rain-drops, and when you saw it there was a rain-shower somewhere in front of you, the sun was behind you, and your shadow pointed towards the middle of the rainbow more truly than the magnet points to the north. Perchance a cloud passed across the face of the sun; then the rainbow vanished. Therefore the two essentials for producing rainbows are rain-drops and sunshine. Let us now experimentally determine how a rain-drop acts on sunshine or any other light.

A rain-drop is a little globule of water which on its way towards us is constantly growing bigger by taking to itself lesser drops which it comes in contact with on its way earthwards. If it pass through a very cold layer of air the drop is frozen, and we are pelted with a hailstone, which, if perfectly formed, will be really a tiny ice-ball. What we want to learn, then, is this—How does a globule or a globe of water influence a sunbeam or a light-beam of any sort? To answer the question yourself, procure a nice round carafe or flask of water, with its outside as plain as the outsides of the rain-drops you have seen at times hanging from the casement; it must be embellished with no glass-cutter's art, for such ornamentation, however desirable on other grounds, would quite perplex us and spoil the experiment. Try now and imitate the conditions you met with when you were gazing at a rainbow, i.e., have the flask full of water before you to represent a rain-drop, and a candle or lamp-light shining on to it just as if its rays proceeded from a distant source, such as the sun or moon. You will see an

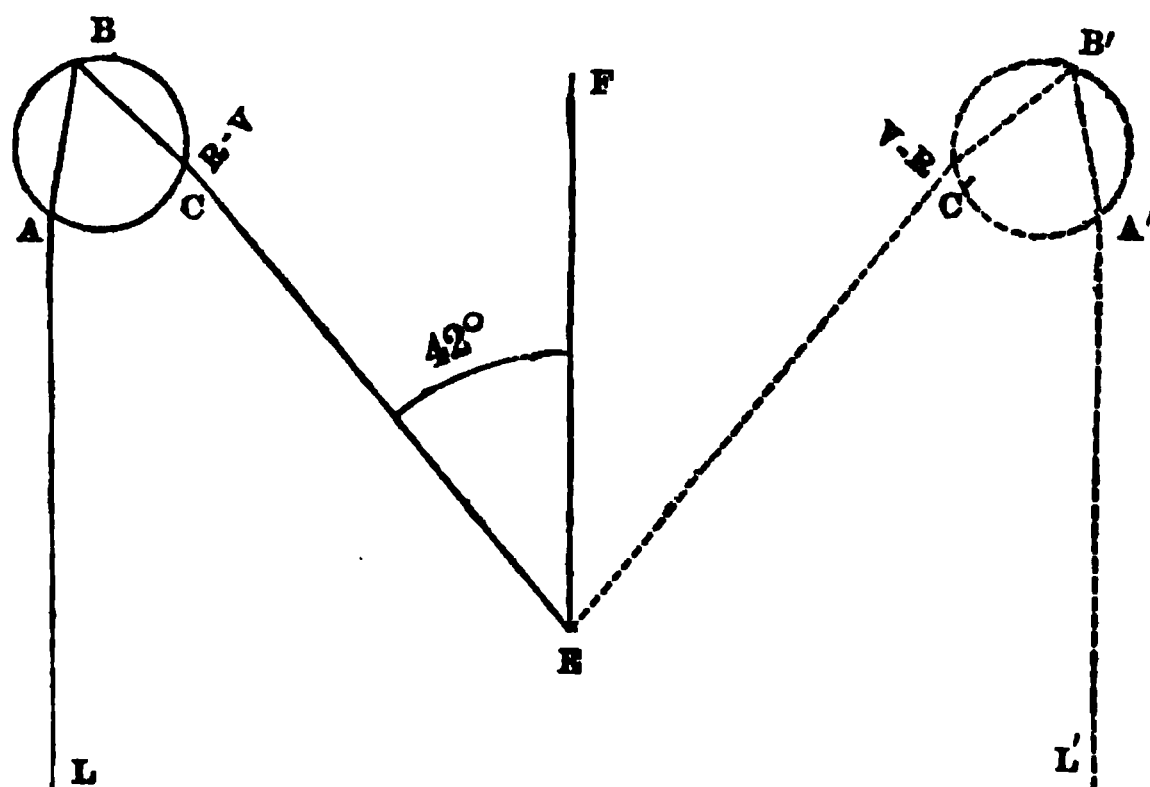


Fig. 78.—SUN-LIGHT PASSING IN AND OUT OF A FLASK.

image of the lamp on the front surface of the flask, and you will likewise see a second image, which is reflected from the hind surface of the flask of water. This second image is coloured, its left side being red and its right side violet. Now if we were to put down our result on paper in the way of a diagram, it would be something like this (Fig. 78), where L is the position of the lamp, A B C that

of the flask, and E the position of your head. The light from L passes into the flask at A, proceeds in the direction A B, is reflected at B, and emerges at C. It is at C where we see the coloured image. That the light passes in at A you may prove easily enough by covering that spot with an opaque screen, and when this is done you see an image at C no longer. Now, the sun is so big and so far off that in considering problems of this kind we are quite safe

in saying that his rays, falling over a very large area, are parallel to each other, and if we had used sun-light instead of the lamp-light, the shadow of the observer would have fallen in the direction $E F$ parallel to the ray of light $L A$; and if we were, moreover, to measure the number of degrees in the angle made by the coloured rays proceeding from C , in the direction $C E$, and the shadow line $E F$, in other words the angle $C E F$, we find it to be about 42° . In every position of the flask where the rays from it make an angle of 42° with the shadow line $E F$, we see the same coloured image of the sun; and if you imagine how a string of flasks could be placed to fulfil this condition, you will perceive that the string would have to be in the form of an arch, and such an arch of flasks, if the parallel rays of the sun fell on them, would present us with a bow of coloured images of it. We have in the rainbow myriads of coloured images of the sun all merging into each other, and they are produced by the falling rain-drops. As each rain-drop enters this magic arch it exhibits its coloured image of the sun, and as it falls others enter to supply its place, so that if a rainbow lasts only for ten minutes it would take a long row of figures to express the number of drops which had helped to make the bow. We have so far been speaking of the inner bow, but we generally see an outer bow too.

This outer or secondary bow is formed by rays from the sun which have been twice reflected within the drop in a fashion which will be understood after an inspection of Fig. 79. The observer standing with his back to the sun has a shadow in the direction $E F$, as before. All rain-drops in the arch I give rise to the inner or primary rainbow in a way we have just explained; and all drops in the dotted arch marked II give rise to the secondary bow. Let $A B C D$ be one of these drops. A ray of light ($L' A$) from the sun enters the drop at A , is reflected at B , and again at C , and emerges at D on its way to the eye. If you work this out with the flask, you will perceive there is a reversal of the order of colours, and similarly in this secondary rainbow the colours are in just the opposite order to those of the primary.

The light of a rainbow is polarised, but to understand what this means you will have to study a very enchanting department of optical science called *polariscopy*.

POLARISCOPY.

There are some things in light which, although exceedingly beautiful to see, are not easy to understand. Nothing is so lovely as some of the effects of polarisation; but unfortunately, or perhaps fortunately, only patient reading and thinking will enable you to understand even the elements of the subject which we shall give here; and for more abstruse information you will, of course, have to refer to works of a more advanced kind. You must turn to this subject of polarisation with a determination to understand it, and just as you would spend a toilsome hour to get up to the top of an English fell for the sake of the scenery to be seen from it—black mountains, surmounted by blacker mountains still; glassy-looking tarns, and silvery streaks on their way to the sea—even so

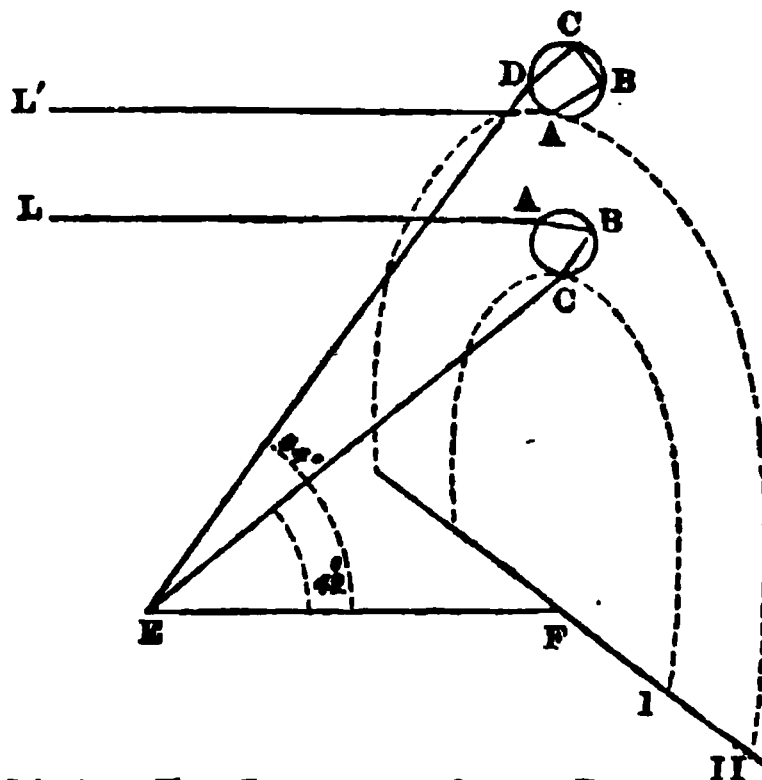


Fig. 79.—THE INNER AND OUTER RAINBOWS.

must you try to surmount the little difficulties of polarisation for the sake of the pleasure you will have in afterwards surveying its beauties—a perennial pleasure,

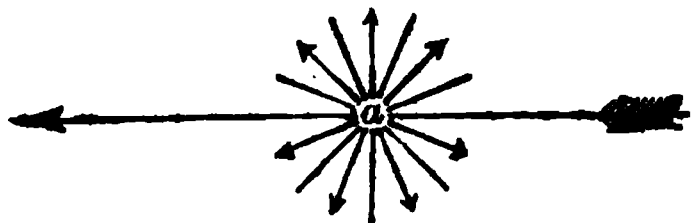


Fig. 80.—THE MOTION OF AN ETHER-WAVE.

we would further add, because, when you have made your polariscope and prepared your objects, they are there to study at all times, and to show to your friends.

We have hitherto supposed that, in the transmission of an ether wave, the motion of an ether particle is a simple up-and-down motion. So it is for some particular ether particles; but of the myriads upon myriads that must exist even in an amount of space which we should call a point, there must be a variety of directions of motion in the plane at right angles to the direction of the wave. Perhaps we can best figure this to ourselves by means of a diagram. Let the big arrow (Fig. 80) represent the direction an ether wave is travelling in. The motion of the ether particles at any particular spot where the wave passes (as at *a*) may be to and fro in every direction in the plane at right angles to the arrow, i.e., to the direction of the wave-motion.

Now, in passing through transparent bodies, we may imagine that light may, to some extent, be influenced by having the motion of some of these ether particles stopped. Suppose, for example, we have a substance with its rows of atoms or ultimate particles arranged as in *A* (Fig. 81), and that a horizontal ray of sunlight passes through it. It is evident that little or no obstacle would be presented to the ether particles which had an up-and-down motion; while, on the other hand, those whose motion approached to or was a side-to-side motion would be ultimately stopped. In this way only a portion of the ray would issue from the other side, and the ether particles producing its waves would move in an up-and-down direction. Such a ray would be said to be polarised.

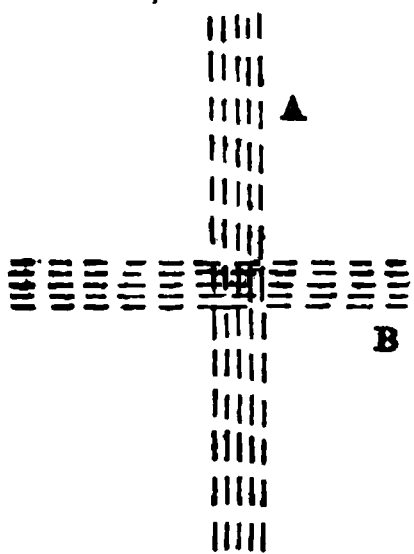


Fig. 82.—ARRANGEMENT FOR QUENCHING MOTION OF ETHER PARTICLES ALTOGETHER.

If we were next to present to the ray that has just passed through *A*, a similar transparent plate (Fig. 81, *B*), placed horizontally, it is apparent that now the up-and-down motion of the ether particles, coming in contact with atoms above and below them, would finally be stopped, and to the eye there would appear nothing but darkness.

We may imagine something of this sort to take place when light is passed through plates of the mineral tourmaline which have been cut in a direction parallel to the axis of the crystal. When you pass a ray of sunlight through a slice of this substance, some such operation as we have fancied in the case of Fig. 81, *A* takes place, for the ray issues from the other side less intense and polarised. When this polarised ray is regarded with a similar slice of tourmaline, placed horizontally as at *B* (Fig. 81), so that they cross, as at Fig. 82, you observe a dark square, for the ray has now altogether been quenched, and the crossed tourmaline plates present the appearance of Fig. 83.

Light may be polarised by reflection. A beam that has been reflected from

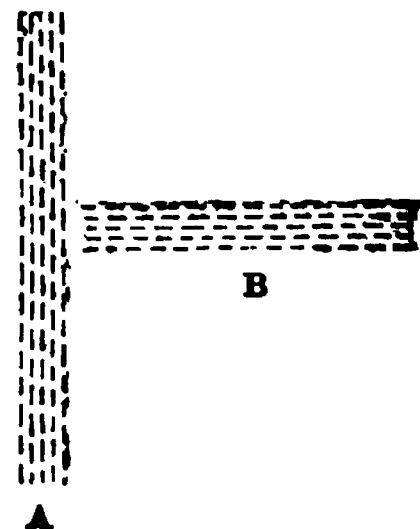


Fig. 81.—ARRANGEMENT OF ATOMS FOR REDUCING MOTION OF ETHER PARTICLES INTO ONE PLANE, IN A PERPENDICULAR, AND IN A HORIZONTAL DIRECTION.

the surface of glass, water, polished furniture, &c., is found to partially disappear, and at certain angles to wholly disappear, when it is examined by means of a crystal of tourmaline, which you of course turn round to get it properly disposed for the experiment. It would thus appear that such a beam of light, after impinging on a surface of glass or water, has most, and at certain angles all, of its vibrations reduced to a common plane.



Fig. 82.—CROSSED TOURMALINES.

Now, if such a beam of light which has been reflected from a surface of coloured glass be reflected by a second surface of coloured glass, you will find that in a particular plane and angle the latter quenches the beam, thus acting like the tourmaline. Such an arrangement of two coloured glasses would form an exceedingly simple polariscope, and the first plate receiving the light is known as the *polariser*, and the second plate used for examining the polarised beam is called the *analyser*. The angle at which the light must fall on the first plate of glass is $56^{\circ} 45'$, and at this angle the light is completely polarised; the second plate, or analyser, must also receive the polarised beam at an angle of $56^{\circ} 45'$, and the two plates must be perpendicular to each other. Under such circumstances, if you bring a plate of unannealed glass between the polariser and analyser, you will see its image in the analyser with the beautiful coloured pattern characteristic of it.

Fig. 81.—A POLARISCOPE.

HOW TO MAKE A POLARISCOPE.

Take (Fig. 84) a piece of deal about 8 in. by 3 in., and half an inch thick, for a stand. A square of glass (*a b*) which has been painted black on the back must be let into it; this is the polariser. Two wooden supports (*c d*) must now be fixed on each side of this plate, making with the polarising plate an angle of about 34° . A cardboard stand (*e*) may be fixed to them, with a round hole in the centre for holding polariscopic objects. And now we require an analyser. A round hole must be bored in a cork, and then the cork must be cut in two, in a direction making an angle of about 34° , with the axis (Fig. 85). On to the elliptical surface of the lower half of the cork about half-a-dozen plates of watch-glass may now be secured, each separated from the other at the edges by gummed tissue paper. The upper half of the cork is now fixed on to the lower, so that the round hole in it appears continuous with the hole in the lower half. This is the analyser. The cork may now be fixed in a small paper tube about a couple of inches long, and another tube will have to be made for it to slide in, this latter being fixed parallel to the wooden supports, and clamped to a piece of wood joining their upper ends. If ordinary daylight be now falling upon the polariser, and an object be placed on the stand at *e*, its peculiar polariscopic phenomena will be observed upon rotating the analyser.

Fig. 85. CORK SLIT IN TWO FOR THE INSERTION OF GLASSES.

It is necessary to add here that in the polariscope we have just described we take advantage of polarisation by refraction in the analyser, for whenever a beam

is polarised by reflection the refracted portion of it which enters the glass is equally polarised.

PREPARATION OF OBJECTS FOR THE POLARISCOPE.

Perhaps one of the most beautiful objects to be viewed by the polariscope is unannealed glass, and the following are simple directions for making a few specimens:—Procure some glass about a quarter of an inch thick, and get the glazier to cut it up into squares of one and a-quarter inch size. This is annealed glass—the ordinary glass of commerce—and we require for polariscopic effects to unanneal it. Take a piece of schoolboy's slate, and place it in the fire between a couple of the bars. Put on it one of the squares that have to be unannealed. The slate and the glass will in time grow red-hot, and in order that the heat of the glass may be equable, we must keep turning it round with a long piece of strong wire. To this end it is better for the wire to have a loop at the end, so that one of the corners of the glass may easily be pulled towards you, and the next corner may then as readily be pushed away from you. You may thus get your glass equally "cooked," if one may be allowed this homely word. When the glass is hot enough—and a little experience teaches when it is so—take it out of the fire and slide it from the slate on to a plate of cold iron. If the glass be not hot enough it may break into a hundred pieces immediately upon coming in contact with the cold iron; this, however, will not take place if it has been heated to the required degree. After the treatment we have now sketched, the particles of the glass are under a strain, and for this reason all the plates we thus prepare will not last always, for some may break in the course of a fortnight, a month, or they may last for a few years. As, however, they will not cost much more than a halfpenny each, more may readily and cheaply be made. Upon bringing such a piece of glass between the polariser and analyser, by placing it on the stand (s), the beautiful black and coloured patterns cannot fail to furnish much pleasure and instructive amusement.

Pebble spectacle glass, when brought on to the stand, will give rise to concentric and beautiful rings of colour. In trying the experiment, incline the glass at various angles. Thin plates of mica or selenite, which may easily be split off thick specimens with your penknife blade, may be placed on the stage. The colours will be seen to disappear and reappear as you rotate the analyser.

THE MICROSCOPE.

LENSES.

IN the construction of instruments for the magnifying of near and distant objects various sorts of lenses are employed, and they are generally divided into two kinds: (1) those which bring the rays of the sun together after passing

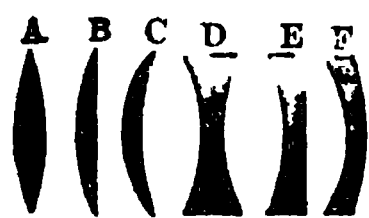


Fig. 86.—DIFFERENT KINDS OF LENSES.

through, and (2) those which spread the rays of the sun out after passing through. In A B C, Fig. 86, we have sections of the first kind of lenses, from which it will be perceived that they are thicker in the middle than at the edges. A is called a *double convex* lens, B a *plano-convex*, and C a *meniscus*. There seems a disposition in Nature to form this class of lens, for we have seen that it exists in the eyes of animals, the crystalline lens being a double convex lens; a falling raindrop, if we could preserve it, would be an excellent double convex lens, and the same raindrop hanging from a flat surface fur-

nishes us with a natural plano-convex lens (Fig. 87). In a common watch-glass we have an example of a meniscus.

The diverging lenses (D, E, and F) would appear to be not so common. They are thicker at the edges than in the middle. D is known as a double concave lens, E as a plano-concave, and F as a meniscus. It will be seen, however, that F differs from C, and the latter is generally spoken of as a converging meniscus, while the former is known as a diverging meniscus. It is from various arrangements of these lenses that our optical instruments are, as a rule, formed, but we may have a useful instrument from only one of them, as in the common magnifying-glass, which is only a double convex lens.



Fig. 87.—NATURAL
PLANO-CONVEX
LENS.

THE SIMPLE MICROSCOPE.

A double convex lens alone did wonders in the hands of anatomists, before the compound microscope had been successfully manufactured, and with a simple magnifying-glass of this kind you also may see a great many wonderful things. Upon holding one of these simple magnifying-glasses, or double convex lenses, at a distance of from one to two inches, according to the focal length, from very small print, you see at once that the letters appear enlarged to three times their size. Now this peculiarity will enable you to make out a deal respecting the structure of plants and insects which you could not make out with the naked eye, so that in your walks abroad an old moss-covered wall will afford you many a specimen for examination; the flowers of the field will be a never-ceasing source of wonder; in insects you will be always finding some new and interesting thing; while even the stones will repay you for an intelligent and attentive scrutiny. Of

course, to tell you all that one might see in this way in the course of a ramble would be to write the natural history of the locality passed through; but although this is out of the question altogether so far as we are concerned, it would be a most interesting and instructive thing for you to attempt. Even if you live in the city you may find a vast variety of objects to interest you if you keep your eyes open.

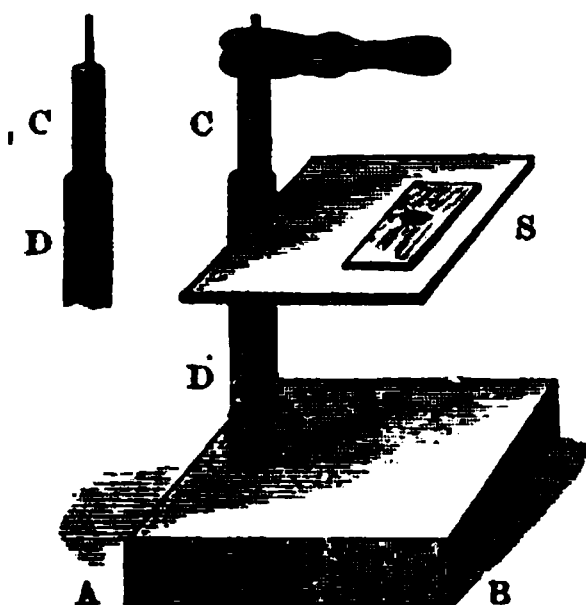


Fig. 88.—SIMPLE MICROSCOPE.

It is very convenient to have this simple microscope so arranged that you have not to hold the lens with the hand. A brass pen-holder (Fig. 88), with one part sliding into the other, may be purchased for a penny. The lower part (D) is soldered to a metal stand (A B), which may be weighted with lead. To the top portion (C), sliding into the other, a piece of straight wire is soldered, and into the handle of your pocket magnifying-glass a hole is drilled, so that you can fix it on to this upright piece of wire. When you now slide the tube (C) up and down, you can adjust the lens at the requisite distance from the stage (S), which is a plate of thin sheet iron or brass soldered to D, and with a hole in it just under the lens. A plate of glass is placed over the hole, and on this the object is put, which may then be examined after adjusting the lens. You will perceive the advantage of such an arrangement as this, for your hands are free to use what instruments you may require in dissecting the object on the glass, and when you are about to have an excursion you can detach the magnifier to take with you.

If you should happen in one of your excursions to find in pond or stream a

specimen of *Chara* (Fig. 89), you will probably be able to make out in it, by means of your simple microscope, a peculiar phenomenon analogous to the cir-



Fig. 89.—*CHARA* (Life Size).

ulation of blood in our own bodies. It is a very interesting sight, and one well worth any amount of trouble you may take to see it. At *a*, *b*, *c*, and *d* you see whorls of leaves projecting from the stem at points called *nodes*. Suppose, now, you cut off the portion *c* to *d*, and while the plant is quite fresh lay it on the glass slip and examine it with your lens, you will perceive the matter within it to be slowly moving. There is a constant flow of matter going on, which is technically termed *cyclosis*.

You will also be able, under favourable conditions, to see the crystalline forms of snow in freshly fallen snow-flakes. Some idea of their beauty will be obtained from Fig. 90, which gives the appearance seen with a higher magnifying power.

For picking up small specimens you may be dealing with, a pair of forceps are required, and may be made out of a slip of tin, as at *b*, Fig. 91. Sewing-needles fixed into handles of wood (Fig. 91, *a*) are employed for minute dissection under the simple microscope; you will also require a razor for cutting thin slices of substances for examination. It is, moreover, requisite to have what is termed a death bottle in collecting your insects. For this purpose you must select a wide-necked bottle of handy size, clean it well out, and put in a few bits of potassic cyanide (poison), and cover with a thin layer of silver sand. This has now to be covered with a thin plaster, consisting of a mixture of plaster of Paris and silver sand, and when the layer is hard you cover it with a piece of blotting-paper. Into this you pop your insects when you catch them, so that they are dead when you come to dissect them. Of course, in dissection of this sort you must follow the directions to be found in works on insect anatomy; and, as a piece of friendly advice, let me urge you not to permit the jaw-breaking words you will at first come across to disgust you with the subject, for with patience you will soon become familiar with them and their meaning, and thus have at command a scientific language.

Fig. 90.—SNOW-CRYSTALS.

THE COMPOUND MICROSCOPE.

You already know that a double convex lens projects the image of a flame on to a screen placed to receive it, and a magnified image of the flame will be produced if you hold the lens at its focal distance from the flame. This image on the screen you may further magnify by viewing it with a second lens. It is not necessary, however, that you should have a screen, for if the two lenses be in the same line the first one projects an image into space, which the second takes up and magnifies. Now, such an arrangement of lenses would be a compound microscope, and the glass receiving the light would be called the object-glass, and the other the eye-piece. It is found, however, that such a simple arrangement is highly unsatisfactory, because of those defects



Fig. 91. — TEASER (a) AND FORCEPS (b).

in lenses of this kind which we have already pointed out (p. 445); the defect arising from the surfaces of the lenses being parts of spheres, and the defect resulting from such lenses acting on white light to some extent like prisms. In modern compound microscopes it is the aim of the optician to get rid of these defects, to make instruments in which objects appear neither blurred nor with coloured outlines; he, therefore, has been led to make his object-glasses of a compound nature, consisting, as a rule, of a double convex lens of crown glass cemented with Canada balsam to a plano-concave lens of flint glass (Fig. 92), thus getting rid of coloured outlines; while to rid himself of the blur several of these compound lenses have been employed together.

The eye-piece consists of two plano-convex glasses, called respectively the eye-glass (E E, Fig. 92), and the field-glass (F F); the latter increases the size of the field of view, and the former further magnifies the image of the object which is being looked at.

Fig. 92. — INSIDE OF A COMPOUND MICROSCOPE.

Upon turning to see the external arrangements of such a piece of apparatus, we find the lenses confined within the tube (T O, Fig. 93). There is a stage (s) for the reception of objects, which are placed between plates of glass, and as light is a matter of extreme importance, there is provision for illuminating both transparent and opaque objects. If the object be transparent, the light of a lamp is received by the concave mirror or reflector (M), and sent through the object on the stage (s) into the microscope. When the object is opaque the lens (L) is employed to bend rays from the lamp on to the opaque object in such a fashion that the light reflected from its surface enters the object-glass at O. The eye-piece at E and the object-glass at O may each be replaced according to your requirements as to magnifying power.

Now, there are all kinds of compound microscopes, their size and form, &c., depending to a large extent upon what one pays; but, whatever the form, you will soon learn to use

Fig. 93. — COMPOUND MICROSCOPE.

it, and if it has to be anything better than a toy in your hands you will prepare your own objects.

PREPARATION OF OBJECTS.

It is surprising with how few tools an earnest student of natural history may work, because although he has, for example, to deal with every kind of organic object in his study of biology, you will find him passing through a most elaborate course with a few bottles of chemicals, a simple microscope, a few teasing-needles (p. 461), a pair of forceps, a few scalpels, and a sharp razor. The scalpels you may readily make from the nibs of steel pens, making them handles like the teasers, and the chemicals you have of course to purchase. You require a solution of caustic potash in water, a small stoppered bottle of Canada balsam, a few bits of iodine dissolved in a solution of iodide of potassium, and some spirit of turpentine. More than these you will only want when you launch out extensively into the art of preparing objects.

The use of these instruments and re-agents will be evident from a consideration of the following couple of examples. From your ramble you have brought home, let us say, a bracken, and you proceed to cut the underground portion of it, or rhizome, in two. Upon examining the section, you see most distinctly markings unlike what you have been accustomed to observe in sections of plants before. You therefore proceed with your razor to cut a transverse slice

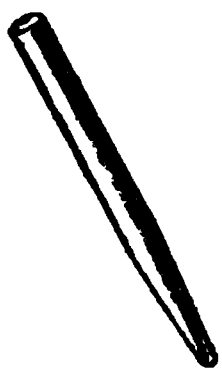


Fig. 94.—DIPPING TUBE.

off it, taking care always to cut from you with a steady hand. After a little practice you will be able to get sections so thin that they are quite transparent. These are placed on glass slips measuring 3 in. \times 1 in., moistened with a drop of water, and covered with a small circle or square of very thin glass, sold specially for this purpose. Do not forget to steep your rhizome in water before attempting to get a transparent slice from it. Upon now examining the section with a low power, you see various kinds of what botanists term cells. As you will presently see, the word cell has another meaning, and you must keep the two meanings separate in your mind. Introduce a drop of the iodine solution under the thin glass cover, to ascertain how it stains the section. You manage this by dipping a glass tube (Fig. 94) into the solution, and then, before withdrawing it, closing the other end with one of your fingers. Upon inserting the pointed end of the dipping-tube under the glass slip, and allowing air to enter the top end of the tube slightly, a drop of the iodine solution flows out to stain the section. Some parts of the section become blue, thus showing us that the granules in this part are starch (p. 543). And now, after you have made these observations, you ought to draw what you see as accurately in your notebook as you can, giving life to your sketches by employing coloured pencils here and there to copy the tints you observe.

For cutting transverse sections of wood an implement of this sort is often used (Fig. 95). A plate of metal (*a b*) with a round hole in it has a tube (*c d e*) soldered to it, into which a very fine screw works at *d*. The piece of wood from which the section is required is cut so as to fit into the tube, and the top portion is next cut off with the razor, so as to make it quite level with the surface of *a b*. A slight turn of the screw (*c*) now raises the surface of the wood slightly, and upon bringing the wet blade of the razor along the surface of *a b*, a very thin transverse section of the wood is obtained. For sections of the wood in the long direction an ordinary carpenter's plane

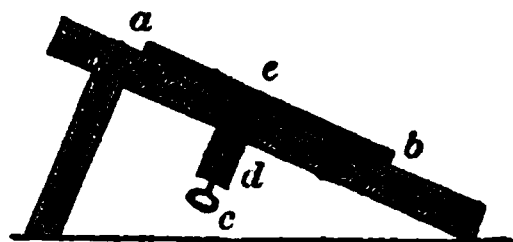


Fig. 95.—SECTION CUTTER.

may be used: nay, you may often obtain shavings quite transparent and thin enough from the workshop.

Your work with the microscope may consist largely of making what one might term *temporary* sections of this kind, but when you find something which you think worth while keeping you have to take special measures for preserving it. We cannot do more here than give you a typical example of how this is generally done.

And first, to be quite clear, you must understand the microscopist's terms. Suppose *a b* (Fig. 96), to be a slip of glass which he calls a "slide." Just around the centre you may draw a ring of gum (*c d*), which, when it dries, will stand up a fraction of an inch above the level of the glass, and thus form a hollow, or "cell." For making cells on slides, an instrument is used which ensures uniformity in them. You will readily understand it from the following explanation (Fig. 97). Suppose *e f* to be a section of a circular plate of metal, with a hole in the centre at *i*; if you have a flat slab of wood (*g h*), with a smooth surface, and a pivot fixed at one end on which *e f* can work easily, you will be able to spin *e f* around like a wheel. If now the slide (*a b*), be fixed on *e f* with a piece of sticky material at each end, cobbler's-wax for example, you will be able to spin the wheel round with the slide attached, and upon touching the slide at *c* with the gum-brush while the wheel is rotating, a ring of gum is drawn on the glass, and you obtain a better cell than if you had used the hand alone. Of course the turn-table sold is more elaborate than this. There are springs attached to the surface of *e f*, so that the slide (*a b*) may be firmly fixed down; the edge of the table is also milled in order that it may readily be turned round. And now for preserving a specimen, an operation which is technically termed "mounting."

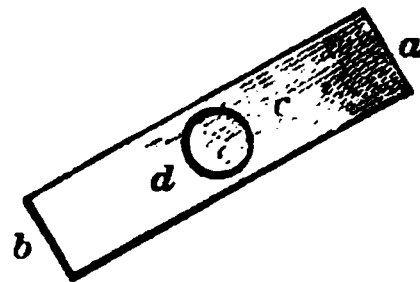


Fig. 96. - A SLIDE.

Let us try and catch the male cricket which is somewhere merrily chirping and calling for its mate. The sound is thought to be due to his rubbing his wings together; so we will suppose we have caught him, and ended his song by popping him into the death-bottle. We now clip off his interesting wings. Soak one of them, or both, in the solution of caustic potash for a day or two, and in passing we may say that this treatment is to



Fig. 97. - TURN-TABLE.

dissolve away the fatty matter. Wash the wing well now with pure water, and press between two slips of glass and keep there until quite dry. Now it must be soaked in spirit of turpentine for a dozen hours or so; and finally place it in the cell you have prepared, and drop on to it a globule of the Canada balsam. You may find it necessary to thin the balsam with the turpentine.

By the aid of a gentle heat from your spirit lamp, the clean, thin cover glass may now be pressed down over the object, and after a little extra cleaning it is ready ever after for showing to your friends.

This is a simple case of mounting. In dealing with other objects you may have more and seldom less difficulty. Instructions, however, for treating special cases, will be found in books devoted entirely to this subject.

Before the microscope was brought to its present state of perfection we had very little idea as to the way in which matter, organic and inorganic, is built up. Much has been done, but there are still vast regions to explore, and discoveries to make, so that the microscopist may never, like Alexander, have to sigh for fresh worlds to conquer.

THE TELESCOPE.

EVERY now and again people are astonished by some great invention; a want has been very much felt, and the want is supplied. Before the commencement of the seventeenth century many would be the wishes of intelligent people for sight piercing enough to detect their friends or enemies a long way off; to make out the nature of sun, moon, and stars; and correspondingly great would be their astonishment when they learned in later times that an instrument had been invented which was a powerful help to the eye, enabling men to bring objects a long way off comparatively near, so to speak. *Telescope* (Greek, *tele*, afar off, and *skopeo*, I view) was a fitting name for such an aid to vision, and before long it was used for scrutinising the surface of the moon and planets, as well as earthly objects. As the result of nearly three hundred years' intelligent attention, it has been improved in every way, and wonderful things are now done with it, especially in surveying the heavens. You may make a very good and serviceable telescope for astronomical purposes at a very small cost, for you only require a couple of lenses and suitable tubing to place them in.

HOW TO MAKE AN ASTRONOMICAL TELESCOPE.

Procure two convex lenses from an optician, one with a focal length of about three feet and the other of an inch. Ascertain their exact focal lengths by seeing at what distance you have to place a screen to get a good image of the sun on it. Suppose the larger lens has a focal length of $37\frac{1}{2}$ inches, and the lesser one of

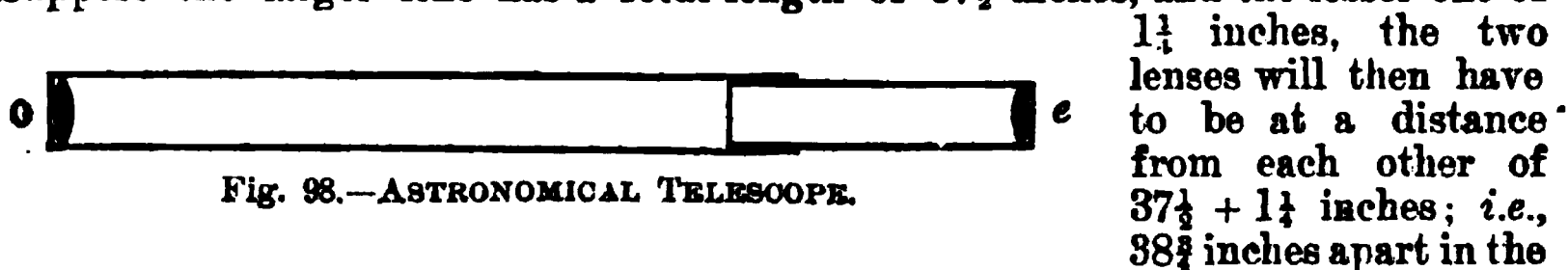


Fig. 98.—ASTRONOMICAL TELESCOPE.

tubing. You therefore get one piece of tubing of a diameter equal to that of the larger lens, and, say, of about 30 inches long. It may be made of tin, or of stout cardboard, and into one end of it the larger lens is fixed. Another tube is now made which will nicely slide in and out of the larger one, and about 12 inches long. Into one end of this the lesser lens is fixed. You now have a telescope in which you can make the lenses just the required $38\frac{1}{2}$ inches apart, or a little more or less. When you point it to a distant object the big lens casts an image within the tube $37\frac{1}{2}$ inches from it, and the lesser lens has to be adjusted so that it can, in a way, take up the image and magnify it.

Such lenses as we have employed here have, however, those defects which we have already pointed out, and to get rid of them their rims must be covered with rings of cardboard, so as to cut off objectionable rays (Fig. 99). The ring of cardboard (Fig. 98) around the object lens (O), must reduce its diameter to about an inch; and a similar ring must be employed at e to cut off the marginal rays before they enter the lens. These "stops," or diaphragms, are represented in the diagram in section. Both the tubes must be well blacked inside.

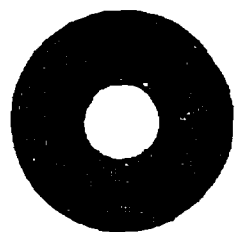


Fig. 99. —
STOP OR
DIAPHRAGM.

With such a telescope as this all objects appear upside down, so that it will hardly do for land objects; but you will find it a charming companion for surveys of the heavens. You will be able to make out the nature of lunar scenery, and the view of mountains and craters will always be a pleasing sight (Fig. 100). You will also be able to see Jupiter's

moons (Fig. 101), that we have had occasion to speak about, and when the sun is spotted you will have no difficulty in making out its spots. In observations of the sun do not fail to have a couple of plates of tinted glass in front of the object glass, or else a plate of well-smoked glass. If you neglect this precaution your eyesight may be badly injured.

The wonderful magnifying effect which is here obtained, arises from the rays being bent which enter the telescope; hence, all such instruments are known as Refracting Telescopes. There is a kind of telescope, however, in which a hollow

reflector does the main part of the work, and telescopes of this kind are known as Reflecting Telescopes.

Fig. 100.—THE MOON AS SEEN WITH THE TELESCOPE.

PRINCIPLE OF THE REFLECTING TELESCOPE.

The hollow of a spoon is a concave reflector. Hold such a spoon, well burnished, on one side of the gaslight; you see in it a small image of the light. Upon examining this image with your pocket lens, you magnify it,

and you can now see much more plainly than before an inverted image of the flame. In this very simple experiment you have the principle of the reflecting telescope completely illustrated, for the instrument consists essentially of a large reflector, which forms

Fig. 101.—JUPITER AND SATELLITES.

an image of the object it is directed towards, and of an eye-piece to magnify this image.

HOW TO MAKE THE REFLECTING TELESCOPE.

In Fig. 102 you have a picture of a home-made reflecting telescope, which has a barrel or tube about 6½ feet long. When using it the observer employs

a small telescope attached to the top end of the barrel, for finding the object he is in search of, and when he has it fairly in the field of view he now looks in at the eye-piece of the big telescope, which, in the diagram, is nearly hid by the finding telescope, and sees a highly magnified image of the thing the reflector is pointed to. If we could cut the tube in two (Fig. 103) we should see a section of the concave mirror (*s*) at the bottom; the eye-piece (*e*), with two lenses in it, and a small reflector at *r*. The rays coming from the distant object enter at the mouth (*m*), proceed forward to the concave mirror, or speculum (*s*), and are then sent back, or reflected, to the mirror at

r, which is placed at such an angle that it sends the rays from the glass speculum (*s*), into the eye-piece (*e*).

The making of such a telescope is no mean task, and any boy who may commence and perseveringly

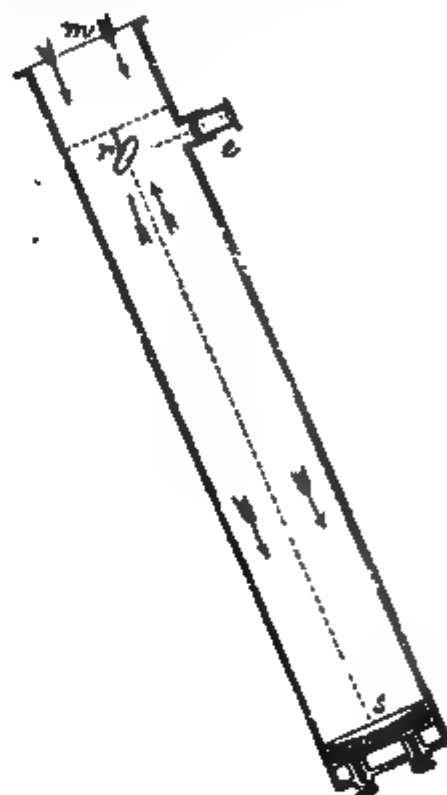


Fig. 102.—REFLECTING TELESCOPE.

Fig. 103.—SECTION OF A REFLECTING TELESCOPE.

finish one will have accomplished a feat which, as a boyish undertaking among boys, will favourably compare with many a stupendous engineering operation among men.

The speculum (*s*) is made of glass, which has had one surface suitably curved and polished, and has then had a thin deposit of silver placed on it, so that it acts like a metallic reflector. It was the custom once to make these reflectors of metal; this material, however, is so heavy compared with glass and so readily receives the slightest strain, that objects soon begin to look out of shape even when the greatest care is exercised. The telescope (Fig. 102) has a glass speculum of six feet focal length and seven inches and a half diameter; and we shall now describe the operations by means of which it was made.

A circular plate of glass was first procured, one inch thick and about seven

inches and a half in diameter; this cost about five shillings. Now, one of its faces had to be slightly hollowed out, so that, after silvering, &c., it would prove an effective reflector. Many tools are required, and we want first a circular

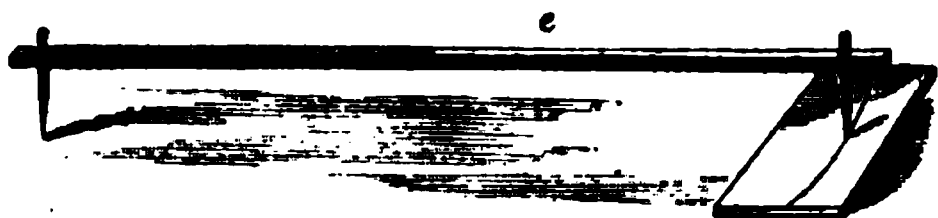


Fig. 104. - CURVING THE ZINC PLATE.



Fig. 105. - MAKING THE WOOD MODEL.

plate of iron with a convex surface, by means of which we can, by constant rubbing, hollow out the surface of the glass plate to the required extent. The method adopted for making the iron tool was this:—A long lath (e) had an iron style fixed in at each end, and twelve feet apart, the required focal length of the mirror that had to be made being one half of this, viz., six feet. And now one style being fixed as a centre, the other will describe a circle of twelve feet radius. A sheet of zinc was then procured, seven inches and a half by four inches, and an arc of this large circle was scratched into its surface in its long direction (Fig. 104). And now the zinc plate was carefully cut in two along the scratched line. A block of wood was next turned so that its slightly convex surface would nicely fit into the hollow of the concave portion of the zinc



Fig. 106. - IRON TOOL.

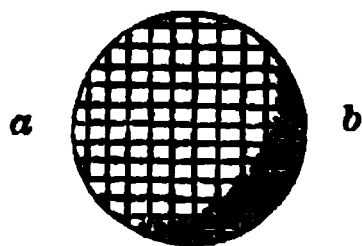


Fig. 107. - SURFACE OF THE IRON TOOL.

(Fig. 105). The wood is the model for the iron tool, which you have now to get moulded, with a handle at the back of the convex surface (Fig. 106). The convex surface of the iron has next to be grooved into lines with a file, so that its surface, when finished, presents the appearance of Fig. 107.

And now the iron tool is ready for grinding the surface of our circular glass plate. Coarse emery and water are placed on the glass plate, and the iron tool is rubbed over it with a cross motion and a rotatory motion, i.e., the grooved face of the iron is moved backwards and forwards over the face of the glass so that every part is rubbed, and at the same time the handle is slightly turned so as to give the rubber a motion of rotation. To manage this well you have to employ a simple device of this kind. At one end, and not far from the corner, of a bench or table firmly fixed, a hole, a (Fig. 108), is bored, just large enough to receive the handle of a circular piece of wood (b). On to this the glass plate which has to be ground is fixed with Stockholm pitch (c); so that now you can turn it round while rubbing backwards and forwards with the iron tool. As you proceed with your grinding, the middle of the glass plate is most rubbed, and a circular area soon shows evidence of this. You carry on the operation until this area has spread over the whole plate, so that now the whole plate is concave.

Finer and finer emery is now employed, until the tool seems to slide over it, and it has next to be polished. You have now to make a fresh polishing-tool, which will not entail so much labour in making as the iron one did. A circular piece of wood of the same diameter as the plate of glass has a handle fixed in the

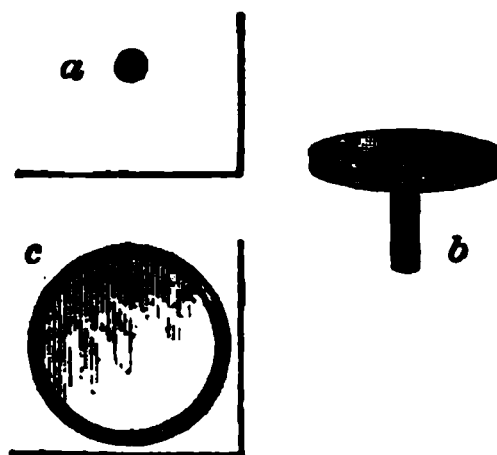


Fig. 108. - STAND FOR GRINDING.

middle of one side; the other side is coated with a mixture to a depth of a quarter to half an inch. The mixture is made by taking sixteen parts of pitch and three of rosin, and melting in an old pan. After you have coated the surface of the wood as described, you warm the ground glass and the pitched surface of the tool gently in water, and then rub the pitch surface over that of the glass until it has taken its curve. This pitch surface, when hard, is now grooved just as the iron was before (Fig. 109); and you finally warm it again, and adjust it to the curved surface of the ground glass, so that it may have its curve perfectly.

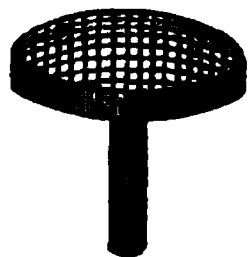


Fig. 109.—THE
PITCH PO-
LISHING
TOOL.

Make jewellers' rouge into a stiff creamy paste, and paint the surface of the pitch tool. Now repeat the same movements you made with the iron tool, until the entire surface is perfectly polished. At this stage you may test the glass speculum, to see whether you have succeeded in giving it the proper curve (p. 470).

Supposing the curve to be correct, it has now to be silvered, and for our information on this point we are indebted to Mr. Browning's book, "A Plea for Reflectors." Three standard solutions have to be prepared:—

Solution 1.—90 grains of nitrate of silver crystals dissolved in 4oz. of distilled water.

Solution 2.—1oz. of pure potash dissolved in 25oz. of distilled water.

Solution 3.— $\frac{1}{2}$ oz. of milk sugar in powder dissolved in 5oz. of distilled water.

Solutions 1 and 2 may be kept for any length of time in stoppered bottles, but the organic solution 3 has to be prepared when wanted. To make a solution for silvering the mirror, 2oz. of solution 1 are placed in a glass vessel, and ammonia is now added drop by drop until the grey precipitate at first produced is dissolved to a clear solution. All this time the liquid has to be stirred with a clean glass rod; 4oz. of solution 2 are now added, and the brown-black precipitate formed must be just re-dissolved by the addition of ammonia, as before. Add about 9oz. of distilled water, and add drop by drop some of solution 1 until a grey precipitate is obtained which does not dissolve after three minutes' stirring; then add 15oz. more distilled water, and set on one side to settle.

Now, prepare the speculum for immersion. Procure a circular block of wood, about two inches thick, and two inches less in diameter than the speculum, which, therefore, in the case we are considering would be five inches. Three pins (1, 2, 3, Fig. 110) are screwed into it at equal distances, and from these stout strings are attached to a ring (r), so that the wood is horizontal when supported. Soft pitch may now be melted in the old pan again, and poured on to the other face of the circular block of wood, and on to this the back of the speculum is now fixed. Moisten the back of the speculum with a thin film of spirit of turpentine previous to placing it on the liquid pitch; this will secure adhesion. Before the surface of the speculum can be suspended in the silvering solution, it must be chemically cleaned. Do this by placing it, attached to the block of wood, face upwards on a level table. Pour on to it a small quantity of strong nitric acid, and rub it gently all over its surface by means of cotton stuffed into the mouth of a small test tube (Fig. 111). Clean the surface and sides well, and then wash with water, and finally with distilled water. The speculum is now ready for immersion; but the solution we have set aside to settle must have two ounces of solution 3 added to it at this point, and it must then be well and gently stirred. It is now poured into a clean circular dish, about

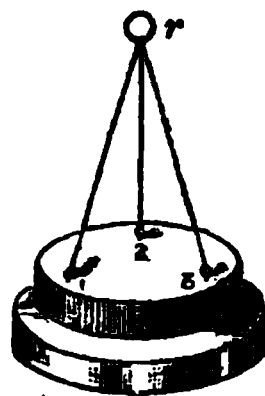


Fig. 110.—SILVER-
ING THE RE-
FLECTOR.

three inches deep, and 2 inches larger in diameter than the speculum, and in this dish the mixing of solution 3 with the other liquid had better be performed. Now, the speculum may be placed in the solution face downwards, and immersed to a depth of about a quarter of an inch. When the silvering is completed the speculum is removed from the solution, and washed with about two gallons of water, and afterwards with distilled water; it is then placed on its edge, reclining against a board, and resting on blotting paper until completely dry. The silver surface, now completely dry, is rubbed with very soft wash-leather, the leather describing the curves given in Fig. 112, and finally with the very finest rouge. It is this speculum grinding, polishing, and silvering which is the great work so difficult to accomplish in making a reflecting telescope.

The speculum has now to be separated from the block, which may readily be done by standing it on its side, and inserting the edge of a very sharp chisel between the glass and the wood, which has then to be gently tapped.

And now as to the remaining parts of the telescope. An iron cell has to be prepared, just deep enough to hold the glass speculum, and wide enough to permit of its being readily put in and taken out. The bottom of it is generally covered with a circular layer of flannel, and on this the speculum rests. The cell is now placed at the bottom of the telescope tube through a door in its side, and its proper position is obtained by means of screws passing through the bottom of the tube.

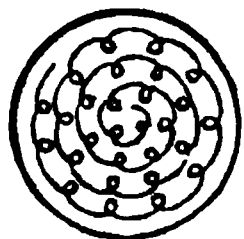


Fig. 112.—BUR-
NISHING THE
SILVER SUR-
FACE.

An elliptical mirror is placed at r , inclined at an angle of 45° to the axis of the tube, so that the light from the mirror may be reflected into the tube (e), containing the two lenses of the eye-piece (Fig. 103). This eye-piece, seen better in detail in Fig. 113, may be bought for 15s. and upwards. Both lenses in it are plano-convex, and of short focal length, (a) having a focal length of about $\frac{1}{2}$ inch and (b) of $1\frac{1}{2}$ inch, and in finding the position where the mirror at r ought to be placed, it will be sufficient to have it fixed where the length of the lines ($s r$ and $r e$, Fig. 103) is equal to the focal length of the lens. In other words, the elliptical mirror must be placed at a distance from the reflector equal to its focal length, minus the semi-diameter of the tube. The eye-piece of the telescope will have to be drawn out or thrust in sufficiently to see correctly. You will see the reason why the mirror at r has to be elliptical. A cone of rays coming from the reflector to the focus will, if cut in an oblique direction, present one with an ellipse, and, therefore, the mirror at r has to be elliptical to send all the rays into the eye-piece. To make the mirror, get a thick piece of glass cut into an oblong shape by the glazier, and now, with the wards of a key, it may be snapped into a rough elliptical figure, and you may grind the edges finally with sand on a flat stone, or on a grindstone. One of its surfaces is now silvered, and then polished, just as the speculum was, and it has then to be mounted in a tin cell, which is supported at the junction of three rods, reaching from a metal ring that is fixed against the inside of the tube just above the eye-piece (Fig. 114).

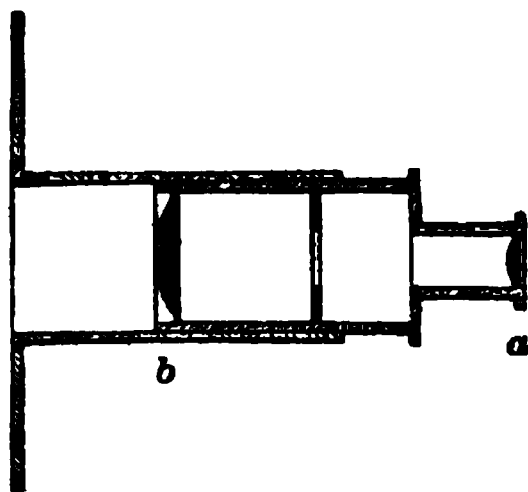


Fig. 113.—THE EYE-PIECE OF
THE TELESCOPE.

And now about testing the speculum when it has been polished, and you are not quite sure whether it has got the proper curve, because the grinding of the



Fig. 111.—
GLASS-
CLEANER.

pitch tool ought to have very slightly altered it from the curve possessed by the

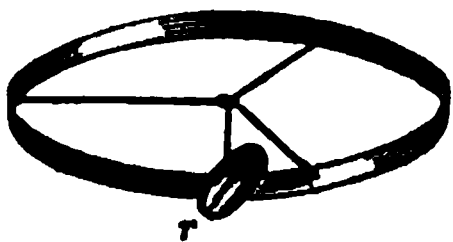


Fig. 114.—MOUNTING THE ELLIPTICAL MIRROR.

with the eye-piece. If the result is satisfactory, then you proceed with your silvering operations.

iron tool, with which the operations were commenced. There are several complicated methods of ascertaining whether the surface has been ground to a proper curve and probably you would understand none of them, save the one we give at this stage of our explanations. The polished glass mirror, in its cell, is placed at the bottom of the telescope tube, and turned, say, to a star or the moon. If the reflector be all right you will see these heavenly bodies perfect in outline, &c., upon focussing

THE MAGIC LANTERN.

WE now come to speak of an instrument which belongs to the same family as the microscope and telescope, for it performs the same duty of magnifying things; but whereas the telescope and microscope are only adapted for single observers—as only one can take a peep at a time—with the magic lantern magnified pictures can be seen by hundreds of people at once. Some of the tricks, too, that can be managed with it are so wonderful, that it well merits the character of *magical*, which it has long sustained, and perhaps no class of entertainments has been so interesting to boys of the past, nor will be to boys of the future. It is not at all difficult to understand. If you have ever been going along a very dark street where there was no light except that coming from a room with blinds undrawn, you would see on the side of the building opposite a magnified image of the whole window; the image of each frame in which a pane was set being quite plainly to be seen. Similarly, in a magic lantern you have a small wooden or tin room containing a strong light, and the rays from it are sent through a peculiarly constructed window, across which there is placed, instead of bars of wood, a pane of glass, called a slide. On this slide a picture has been drawn, and is cast on to a screen placed to receive it at some distance. It is this picture on the screen which the audience sees, just as you before saw the picture of the window panes on the side of the building. A section of a simple magic lantern is shown in Fig. 115. There is a lamp in the middle of it, from which the light comes, and in order that as much light as possible may be used, there is a concave mirror at M, placed so as to send a further quantity of light through the window at C. This window at C is simply a double convex lens, and in front of it, at S, the slide with the picture on it is placed. In order that the picture may be cast on to the screen with the greatest advantage, there is, at P, a sliding tube containing another lens. The box is surmounted by a crooked chimney, up which the hot air ascends. In working with an instrument of this sort, one or two hints will be useful. The centre of the flame must be on a level with the centre of the lens at C, so that a straight line passing through the letters M and C will also pass through the centre of the light source; this

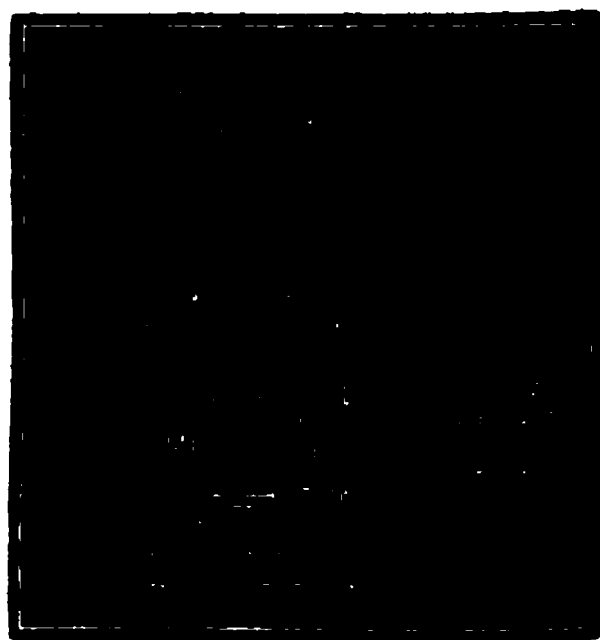


Fig. 115.—SIMPLE MAGIC LANTERN.

you have to see to when trimming the wick. The lenses employed must be scrupulously clean, and for this purpose you have to take them out every now and again, and clean them with cotton dipped in methylated spirit. They have then to be gently rubbed with a clean soft cloth, and afterwards with chamois leather. If you ever use a bull's-eye lamp, which has in it the elements of a magic lantern, you will have noticed that a little while after the lamp is lit moisture is deposited on the lens, and does not disappear until it has become warm. Just the same happens in the magic lantern, and you have, therefore, to let the lamp in it burn some time before you attempt to project pictures with it on to the screen. The best sperm oil is usually employed in the lamp.

DISSOLVING VIEWS.

That magical disappearance of one scene, and its imperceptible replacement by another, is managed in an exceedingly simple way. Two lamps are arranged side by side, as in Fig. 116, with their nozzles so inclined to each other that the light from each forms a circle on the distant screen, perfectly coincident with the other, so that only one large circle of light appears on the screen. On a level with the nozzles there is a couple of combs, fixed to the same bar, with their teeth pointing to each other, and at such a distance that when one nozzle is perfectly covered the other is perfectly uncovered. Now, when the teeth of one of these combs begin to pass in front of a lens, the light reaching the screen is diminished, the scene appears to be fading away, and has completely vanished by the time the nozzle is completely hid by it. In the meantime the other nozzle has had the teeth gradually removed, and the picture it projects has become more decided, until, when the other is completely cut off, it is seen in its full strength and beauty.

Fig. 116. - ARRANGEMENT FOR DISSOLVING VIEWS.

OTHER LANTERNS AND OTHER LIGHTS.

Other lanterns are used besides that we have described, and an exceedingly handy one is the Sciopticon Lamp. A view of it is shown in Fig. 117. Instead of the ordinary lamp, there is a triple arrangement of wicks at A, which are fed with rock-crystal oil. We have derived much pleasure from the performance of a lamp of this kind in a small room, the images having been projected on to a screen made up of sheets of drawing-paper pinned to the wall.

There are also lamps in which the light is supplied by a burning jet of

hydrogen and oxygen directed on to a cylinder of lime, thus giving rise to the well-known lime-light. An arrangement for this purpose is shown in Fig. 118,

where separate streams of oxygen and hydrogen are passed along a couple of tubes, to mix, just before issuing from the nozzle at A, to be ignited. A cylinder of lime is fixed opposite the jet. The gases are supplied to the separate tubes from a couple of strong copper cylinders, in which a supply has been compressed. The hydrogen is sometimes replaced by coal-gas, in which case it may be burnt, as usual, from a jet, while a stream of oxygen is directed into it. Instead of iron cylinders, you may employ gas bags, made of indiarubber-cloth, and fitted with stop-cocks, to which tubing may be attached (Fig. 119). One has to exercise care, however, in making experiments of this kind, for if common air gets into your bag containing hydrogen, an explosive mixture is formed

Fig. 117.—THE SCIOPTICON LAMP.

which will blow up if a light get to it in any way. The following is an account of an incident to the point.

A SCIENTIFIC ADVENTURE.

It was just after the death of that great and good philosopher, Michael Faraday, that two young men returned to their native village brimful of the scientific information which had been imparted to them in the metropolis, and, being fully alive to the unwisdom of hiding their light under a bushel, they determined to give a joint entertainment, which they were sanguine enough would spread their fame, and at the same time fill their pockets—in short, they determined to give a lecture on the Life of Faraday. The eventful evening came round, and beheld the large hall, specially let for such purposes, half filled with people. There was a brave array of apparatus on the platform, and also a gas-

bag, filled with what seems to have been an explosive mixture of gases, which was destined to be used in the production of the lime-light. Now, in a first lecture of this kind there is generally a tendency to hurry,

and if the lecturer does not happen to be as cool as a cucumber, something is sure to be forgotten. It turned out so here. When they came to use the gas-bag, they found that they were unprovided with weights. Many a bold thing has been done before now when lecturers have been hard pressed before



Fig. 118.—OXY-HYDROGEN JET.

unsympathetic audiences ready to laugh at a failure, and only scanty in their praise of a success. The two friends were in a fix; the credit of both was at stake, and all for want of weights to put on the bag. A happy (?) thought struck the lecturer at this moment, and he whispered to his friend, "Sit on the bag." The suggestion was at once acted upon, and while the lecturer was trying to make up for the momentary pause by a rapid flow of language, the assistant put himself to the use of a few fifty-sixes. The jet was now lit. Unhappy moment! for before one could wink the assistant had been blown away, the hall was in darkness, and there was a wild scamper over benches and chairs towards the hall door. The tale goes that the assistant was blown by the explosion out of the window; let that be as it may, he was luckily unhurt. The Faraday lecture is now a matter of history in that village, and our two friends found themselves more famous for a long time than ever they had even hoped for.

Fig. 119.—GAS BAG.

THE SLIDES.

A word or two about slides, and then we have done with the Lantern. You may purchase them from the optician at all prices, and dealing with nearly all subjects. Some of those which are coloured are wonderful objects of art when you come to consider that the picture is painted in a circle of three inches diameter, and exhibits no defects when expanded to eight feet on the screen. The manner of their production is, however, shrouded in mystery, and, as a rule,



Fig. 120.—GLASS CELL FOR GELATINE SLIDES.

one with an artist's ability can only produce poor slides from directions scattered here and there in scientific journals. You may, however, try your hand at the following method, which seems to have originated in America:—Fix a sheet of gelatine, such as the engraver uses, securely over a picture you want for a slide. It may be a diagram in a book, or a comic sketch from *Punch*. The lines of the original are now traced deeply on the transparent gelatine with a steel point, and lead-pencil dust is then lightly rubbed in with the finger. A glass cell is now made by taking a couple of sheets of glass, and separating them around three sides (*a b*, *b c*, *c d*) by a thin piece of card, and paper is pasted round the same edges. This cell is now placed in the

stage of the lantern, and the gelatine pictures are introduced as they are wanted for projection on to the screen.

HEAT.

It is a curious thing what an incentive to question asking is experimenting. And now that we turn to the subject of heat, it is probable that, if you were not anticipated to some extent, the constant query, "What is heat?" would be revolving in your minds while performing the experiments which will now be described. We shall have to guess what heat is, for a start. But as you are no doubt aware, guesses are of two kinds, roughly speaking, and these two kinds of guessing may be well illustrated from your own experience. A comrade of yours has put some marbles in his hands, unseen by you, and now, with fists closed over them, he comes forward and asks, "How many?" Two courses are open to you: you may, in the first place, put your hands in your pockets, give a glance at the closed hands, and come out with a random guess at once, in which case you will probably be a long way off the mark; or you may proceed in quite another way, and make a very close guess, and your method in such a case would be this: You first seize hold of your comrade's hands, and give them a terrible squeeze, to see whether they are as full as he pretends they are. You probably give his knuckles a smart tap, to hear whether the taws within are packed tightly enough together to make a grinding noise, and having, after much labour, ascertained the amount of space these marbles occupy, you are now in a position to make a guess as to their number, for you know very nearly how many it would require to fill up such a space. A guess of this sort will no doubt be very near to the truth.

And now suppose you are asked, instead of the number of taws in a boy's hands, the question, "What is heat?" If you guess carelessly and at random, you reply, "Heat is that which makes me warm or hot." There has been no trouble whatever taken to arrive at this answer: it is made without any considerations or any calculations, and it is wrong; because there are a host of things which will make you warm—the sun, a fire, a heated room, &c. &c.—and plainly all these, which are so very different—sun, house-fire, and heated room—cannot be heat; and the more we think in making the second kind of guess the farther we see the first is off the mark, for we finally arrive at the conclusion that heat is a *something* which may be manifested by every substance, and our final guess at truth is that this something we have now spoken of is *motion* of the atoms or ultimate particles of the substance. We shall see this more and more forcibly as we get better acquainted with the facts of heat.

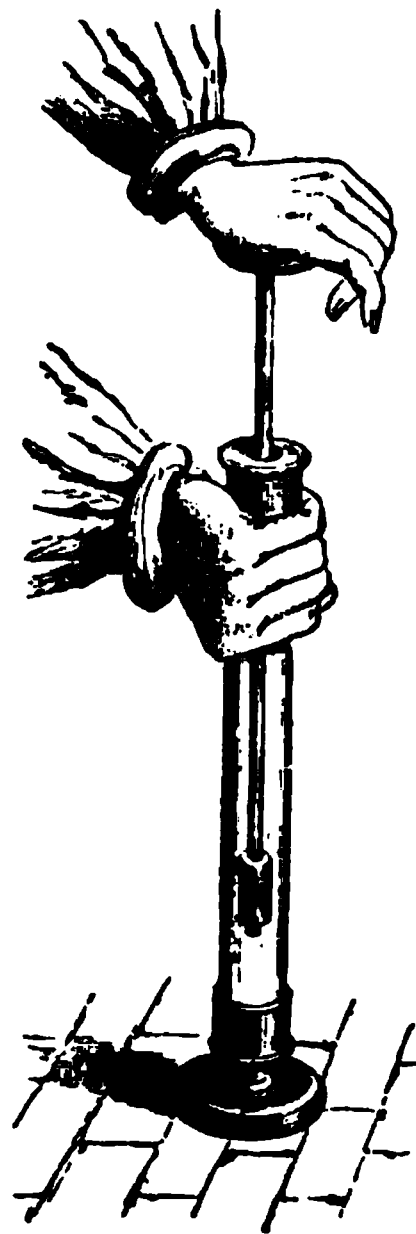
Once for all, then, in guesses at truth we must be as careful as the importance of the subject demands, for if we make a random guess, that guess will fit the facts as badly as a coat you might have had made without measurement would fit you. You know there is every probability that such a coat would have to be sent back to the tailor, and in just the same way your guess would have to be returned as bad and useless. As it is our object to make a good guess at what heat is, founded on observation, we may as well see, in the first place, how heat affects us and things in general.

HEAT IS PRODUCED BY RUBBING AND KNOCKING.

Heat is produced when two substances are rubbed or struck together. No doubt you have often, as a schoolboy, rubbed a metal button rapidly and for

some minutes on a wooden form until the button has been too hot to touch. Savages produce fire in the same way by taking a couple of very dry sticks and rubbing them together until they are ignited, and we likewise use the same method when we take a match and rub its end on the wall or on the side of the box. It will be seen, however, that the labour in the latter operation is reduced to the least possible amount by the match being tipped with phosphorus. This phosphorus is very useful indeed for this purpose, and gives us a ready means of showing that heat is produced in many operations. If you take a stone and let it drop from a height, it produces heat by its sudden stoppage. You cannot, however, detect that such is the case by touch alone, but if you take the phosphorus from the tip of the match and place it exactly where the stone will fall, you will find that the phosphorus will blaze up. Friction, or the rubbing of two substances together, and percussion, or the knocking of two substances together, are two very common sources of heat, for you can scarcely turn round without seeing that it is so. There, for example, is a loaded waggon coming down the hill-side. The waggoner has put the brake on; there is a dreadful shrieking noise, and you see smoke ascending from the wheel until he gets down into the valley. Shafting in our mills likewise requires oiling regularly, otherwise it would soon become red-hot from the friction. On a grander scale we have sometimes vast forests set on fire in the far West by the continued rubbing of branches together when dry and parched; and a vast number of meteors coming earthwards from space are supposed to never reach us, because when they enter our atmosphere with their terrible speed the rubbing against the air as they whistle through it produces heat sufficient to turn them into vapour.

A simple experiment, illustrative of the production of heat by percussion, is readily tried. Take a piece of lead and beat it with a hammer; if you hammer away vigorously you will soon be able to detect the heat produced, even by the touch, and you may make it hot enough to ignite a match when you touch its tip.



HEAT PRODUCED BY THE CONDENSATION OF GASES. Fig. 121.—CONDENSING SYRINGE.

Heat may be produced by compression in the following way:—An air-tight piston is thrust forcibly along a thick glass or metal tube closed at one end. After a few plunges of the piston it will be found that a small piece of gun-cotton placed at its far end will ignite, and the heat is appreciable to the hand upon grasping the end of the barrel. A compression syringe of this sort you may make for yourself by taking a piece of glass tubing about nine inches long and about one-eighth of an inch thick, with a bore of, say, half an inch (Fig. 122). One end must be made up with a tightly-fitting cork. A wooden plunger may now be made, with the shaft rather less in length than the interior of the glass barrel. Around the end of the shaft some soft material may be twined, so that when moving in the barrel it may be pretty air-tight. With such a simple instrument you may perform the same experiments as with the more costly one we have figured (Fig. 121).

HOW TO LIGHT GAS BY MEANS OF A WIRE.

Take a piece of clean platinum wire about three inches long, wrap it round a pencil, so as to make a coil of it; now insert



Fig. 122.—HOW TO MAKE A CONDENSING SYRINGE.

this coil in the top of a Bunsen burner and turn on the gas. As the mixture of cold air and gas passes the wire you observe a very strange thing. The wire begins to glow, and soon becomes hot enough to ignite the gas. Upon bringing down the hand upon the indiarubber tube at *a*, the supply of gas is cut off for a moment, and the wire seems to cool rapidly; but directly you take your hand from *a*, and

allow the current of gas and air to flow over the platinum wire at *p* again, it shortly becomes red-hot, and then white-hot as before (Fig. 123).

It is supposed that the mixed gases are condensed in the pores of the platinum, and that the heat developed by this compression is so great as to lead to the heat manifested by the metal. Very finely divided platinum, usually known as spongy platinum, also possesses this property, so that when you direct a stream of hydrogen gas on to it it becomes red-hot, and ignites the gas. The property is turned to account in Doberainer's lamp. The lamp consists of two glass vessels (*A* and *B*), Fig. 124, a jet (*E*), and a vessel (*D*) containing the platinum. A piece of zinc (*Z*) is placed in the lower vessel, and sulphuric acid is then poured over it, and, as you will learn more particularly farther on (p. 534), hydrogen gas is produced. The upper vessel (*A*) is now fixed

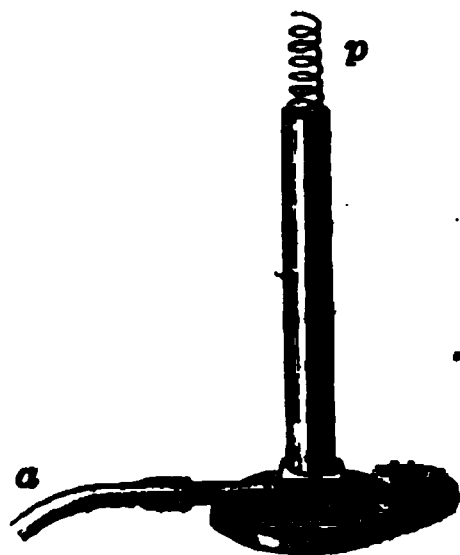


Fig. 123.—MAKING PLATINUM WHITE HOT.

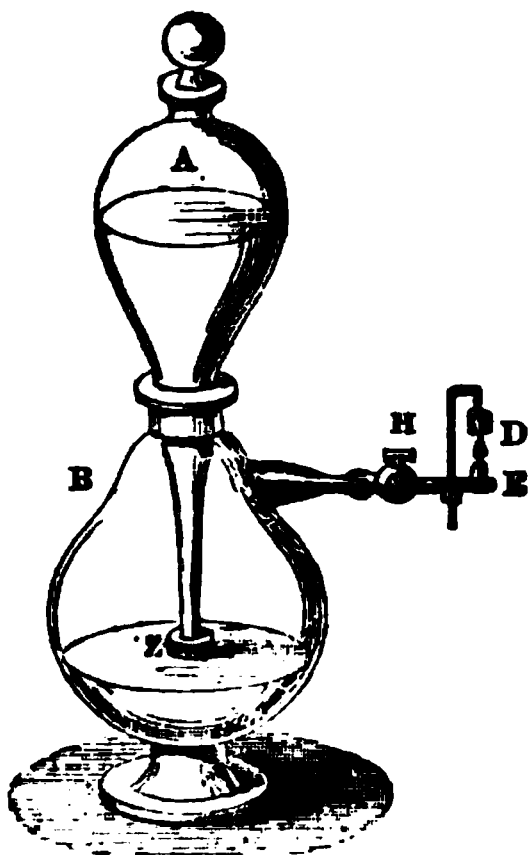


Fig. 124.—DOBEREINER'S LAMP.

tightly in its place, and the pressure of the hydrogen which is being generated soon drives the sulphuric acid through the mouth of the upper vessel, until the zinc is left dry. When the tap (*H*) is turned the hydrogen is directed on to the spongy platinum contained in *D*. The platinum becomes red-hot, and, of course, ignites the gas, which will burn in air. As the hydrogen is being used up the acid in *A* passes down into *B* again, and a fresh supply of gas is generated.

We have now seen that heat can be produced in several ways; let us next proceed to inquire what happens when heat is imparted to gases like air, liquids like water, and solids like the metals.

AIR EXPANDS WHEN HEATED.

This may be proved in a variety of ways, and perhaps the simplest is to take a bladder, and when not quite full of air to tie up its mouth. If you now bring it in front of the fire the creases in it will begin to disappear, and it will seem fuller than at first, because the air within it has expanded, and so stretched out the skin more than before.

You may also get a flask and fit into its neck a cork with a hole in it. Through the hole in the cork a glass tube is passed, which has been so bent as to

pass downwards and slightly upwards at its free end (Fig. 125). The cork may now be covered with sealing-wax, to make it air-tight. Now fill a basin with water, and lay a tumbler down in it so that it may be filled and completely immersed. Upon next lifting up the tumbler, bottom upwards, the water in it will not fall out unless you pull the mouth of the glass above the surface of the water in the basin or bowl. While a comrade is holding the glass in this position, or you may fix it so on a narrow wooden shelf, bring the end of the delivery-tube from the empty flask under the tumbler, and heat the flask with a Bunsen burner. Bubbles of air begin to rise in the tumbler (b). The air within the flask being heated, expands, and finds its way through the tube, and is caught in the tumbler over the surface of the water. At the end of the experiment be careful to remove the delivery-tube from the water before you take away the lamp from the flask, otherwise you will have a breakage.

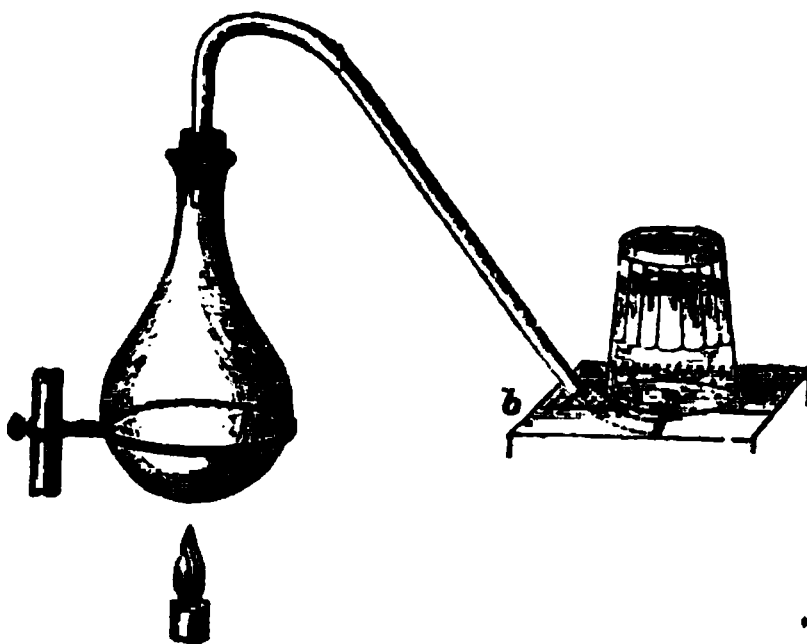


Fig. 125.—EXPANDING AIR BY HEAT.

You will easily perceive that if a body of air expands when it is heated it will also become lighter than colder air, volume for volume; and if heated air of this sort becomes lighter it will ascend, just as a piece of cork, which is lighter than an equal bulk of water, will rise up in it until it has got to the surface, so this heated air will rise up until it gets among air of the same density as itself. The twirling serpent experiment is partly founded on this fact.

TWIRLING SERPENT.

This is a pleasing and very easily performed experiment; in fact, so far as effect goes, it is much more effective than many that are very elaborately got up. The serpent seems automatic, for there appears no visible means of setting it in motion and keeping it going, but it keeps on whirling round for hours nevertheless. To make the serpent, take a sheet of paper and draw a spiral on it, like Fig. 126. Now cut out this flat spiral, so that when one takes hold of the terminal portion, which represents the tail, we get a spiral of paper with its lower end in the form of a serpent's head.



Fig. 126.—CUTTING OUT SERPENT.

Stick a pin through the end of the tail, and now hold the serpent over a candle, sufficiently high so that there is no fear of its burning, but also low enough for it to be influenced by the draught which ascends from the candle. The pin may be stuck in a wooden support over the gas-flame, and then the serpent will be ever on the move. What is it that keeps it going?

The flame of the candle or of the gas-flame is in constant need of air to keep burning. This air comes towards the flame from all sides. One portion of it (oxygen) is greedily taken into the flame, and the rest of it (nitrogen) ascends in the direction of the arrows (Fig. 127), mingling with the very heated air (carbonic acid, &c.) which issues from the tip of the flame. Now, hot air is lighter than cold air, and so it rises in the attempt to find its own level, just as a cork will rise to the surface of water. A stream of air, therefore, plays against the paper serpent,

and coming against its slanting sides, gives it the twist which keeps it twirling round.

A stream of air rises in a similar fashion from any hot surface, and we may make our twirling serpent a test of it. If you take a red-hot poker, for instance, you have now reason to suppose that air which is in contact with its surface is made lighter, and will consequently rise. Let us, therefore, see whether it is so. Take the red-hot poker and hold it upright under the suspended serpent, to see whether the serpent moves. The serpent spins merrily round again. And now, what natural fact can we bethink us of which this simple little experiment enables us to explain? I am sure you have sat many a time by the sea-shore, on some very hot summer's day, enjoying the cool and refreshing breeze coming beach-ward over the deep, deep sea, and

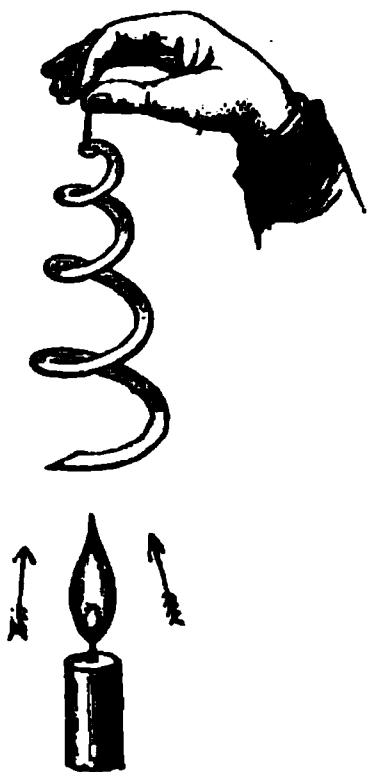


Fig. 127.—TWIRLING SERPENT.

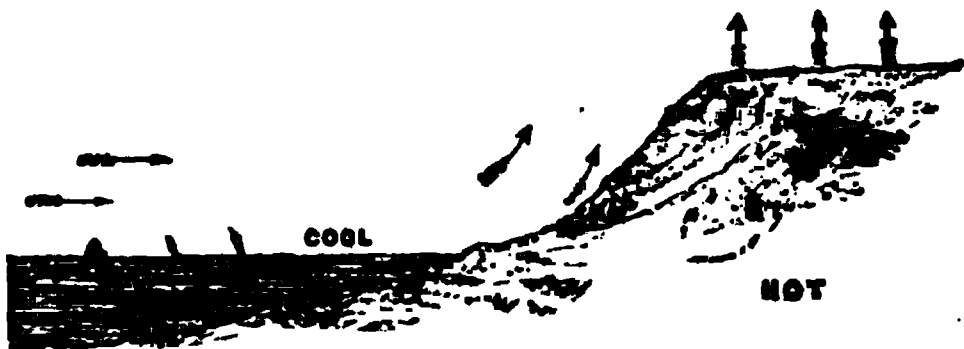


Fig. 128.—ORIGIN OF THE SEA-BREEZE.

probably with never a thought as to how that breeze has been made to spring up. Let us inquire into the cause of the sea-breeze. The fierce rays of the sun have made the earth very hot, so that the atmosphere rises from it in the direction of the arrows (Fig. 128). This happens over a very large surface of land. Air must come from somewhere, to take the place of the ascending columns of atmosphere. The requisite air comes from the surface of the cool sea, at first scarcely perceptibly, a mere breath not sufficient to cool the hot cheek, but after a time the earthward current of air which has sprung up on the surface of the water has developed into a stiff refreshing breeze.

What is really another very amusing form of the same experiment is sometimes managed in the following way:—A circular piece of tin, three inches in diameter, has a small circle drawn parallel to its edge, as in Fig. 129.

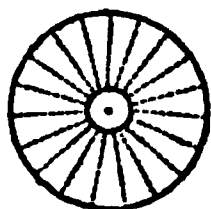


Fig. 129.—CUTTING OUT TIN PETALS.

And now, by means of a pair of shears or scissors, the tin is cut along the dotted lines; we get thus a sort of tin flower, and each of its petals *must be twisted slightly*, so that at the end it is inclined at an angle of 45° to its former position. A metal stalk is next soldered to the centre of the cut tin disc;

and this stalk is turned four times at right angles, so as to form a small

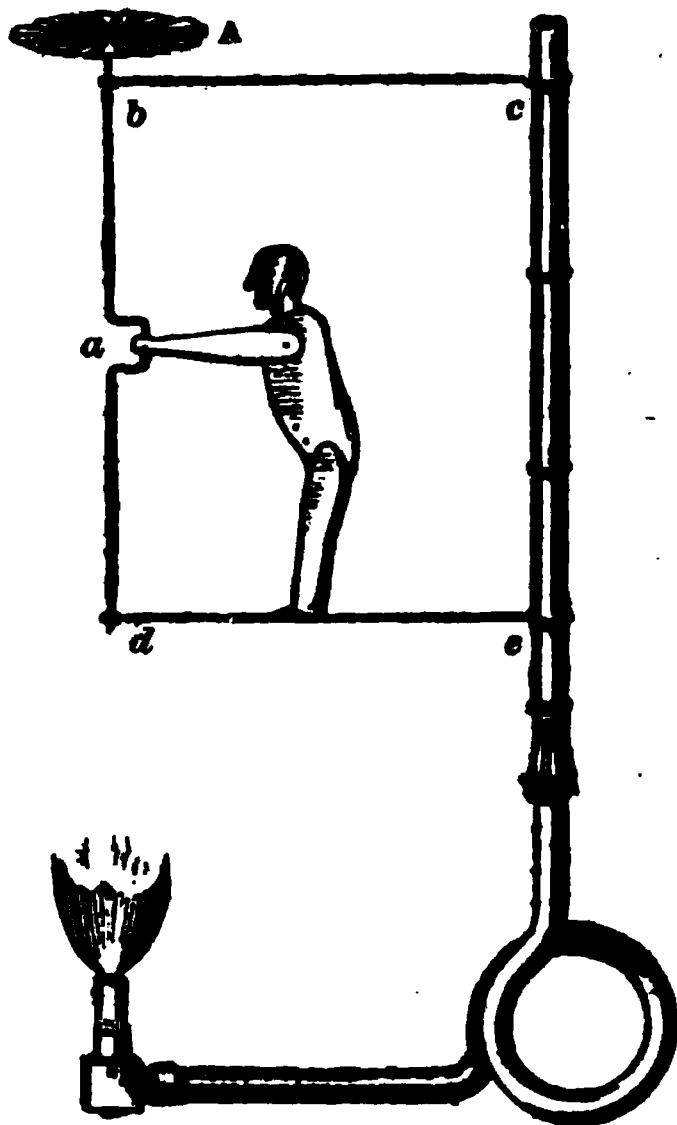


Fig. 130.—WORKING DOLL.

crank (*a*). If two wires, *b c* and *d e*, connect the stalk to the gas-pipe, so that it is free to move round its axis by having a socket at *d* and a minute tube to work in at *b*, then, when the gas is lit below it, it will spin rapidly round. A tin figure may be joined up to it, by having its hands going loosely attached to the crank, and with joints at the shoulders and haunches. This will prove a source of fun to those who do not understand that the tin flower at *A* is the source of motion, for they will regard the figure as the origin of the rotatory movement (Fig. 130).

These uprising currents are called *convection* currents; and you have evidence of their existence in the quivering of objects seen through the heated air rising from hot pathways, fields, &c., in summer.

THE FIRE-BALLOON, AND HOW TO MAKE IT.

In the fire-balloon we have another practical example of the fact that heated air is lighter than the same bulk of cold air. For the balloon is a paper envelope of peg-top shape, which is filled with hot air in a way we shall presently show, so that it rises upwards and floats away, to the delight of all spectators. The balloon may be made of good tissue-paper of different colours to your fancy, or if you desire a large fire-balloon of some twenty feet in circumference, you may make it of brown paper.

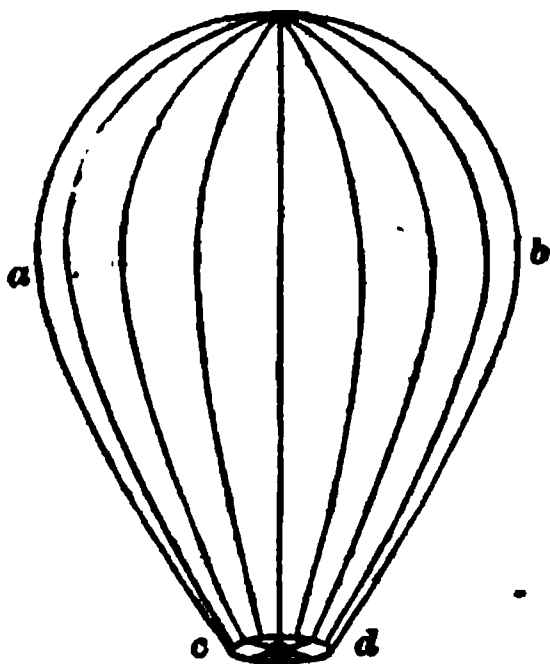


Fig. 131.—FIRE BALLOON.

Your tissue-paper, then, for a start, has to be cut into gores of such a shape that when their edges are slightly overlapping and pasted together you might fancy you had got a hollow paper top, with a circular hole where the peg ought to be. The diameter of this circular opening must be about a fifth of that of the spherical portion of the balloon, so that if you have made it of such a size that the diameter at *a b* is three feet, the circular hole at *c d* must be about seven inches in diameter (Fig. 131). A thin wire has next to be fastened along the rim, and to this two wires crossing at the centre must be attached.

When all is prepared some one holds the balloon while you soak a bit of cotton in spirits of wine. The saturated cotton is now fixed at the crossed wires and set on fire. When the air is sufficiently heated within the balloon will pull as if desirous to rise, and when it is felt that the pull has become strong enough the balloon is liberated. It will now ascend to a great height in the air, unless it comes to an untimely end by being burnt up, a common fate where the balloon has not been properly handled, and one, too, which may prove inconvenient if a dry haystack happens to be in the way.

THE TORNADO AND THE CYCLONE.

It is to heat that we must undoubtedly look, in the first place, for the cause of those dreadful cyclones which rage in the Indian Ocean and the tornadoes which devastate the American continent. The fury of both is something simply indescribable; but if we sum it up in a consideration of the lives that have been destroyed, one might say that a single cyclone has sometimes destroyed more lives than the bloodiest war lasting for several months. We have often made small cyclones in the following very simple way:—A soap-box, with a lid working on

hinges, has its bottom knocked out. Upon now standing the box on one end (Fig. 132), and swinging the lid violently round in the direction of the arrow, or the contrary way, a whirlwind is produced, and to see it you have simply to place small bits of tissue-paper on the ground in front of the box, and these will whirl around rapidly. You will observe that a partially empty space is produced in the wake of the moving door, for it pushes the air away before it. Currents rush in to supply the place of the removed air, and meeting with resistance, set up the whirling or cyclonic motion, which is apparent in the movement of the bits of paper. Now magnify this simple experiment an untold number of times, only, instead of the moving door producing a sort of empty space, have convection currents rising over vast areas. Winds rush in to supply the place of the ascending currents, and opposing each other, give rise to cyclones. The earth spinning round on its axis may contribute to the effect.

Fig. 131.—WHIRLWIND
BOX.

Before we can conveniently proceed farther in our study of the action of heat on substances, it is necessary for us to have some means of knowing how much of it is given to a substance at any stage. Can we use our sense of touch for this purpose? A perusal of the next two paragraphs will show you.

THE PENNY TRICK.

I have many a time seen a most effective trick of this sort tried. A person holds behind him a hat, into which three or four pennies are cast. They are now well shaken up, and we may add that throughout the whole operation the performer never sees the pennies once. After shaking them well up behind him, he requests one of the company to take a penny out, to examine it well so that he will know it again, and then to pass it round for examination among the rest of the company. After it has been well scrutinised by all present, it is now pitched into the hat again, is shaken up along with the others, and the performer now, to the surprise of all present, puts one hand behind him and unerringly picks out the penny that was selected by the company. After having seen it done for half-a-dozen times without detecting any cheating, they become anxious to know how it is managed, and when they are told they all laugh and feel foolish, it is so very simple.

Metals readily become warm, and when a penny is selected from the number in the hat, and passed to and fro in the act of examination, the selected coin becomes much warmer by contact with the hands of the company than the other pennies in the hat. When it is tossed back, the performer can easily tell it by its being warmer than any of the others, even after they have been shaken up together a couple of times. This trick, then, shows us that we may tell slight differences of warmth by means of touch; but we shall now give examples, well known, in which this sense cannot be trusted.

THE JUDGMENT AT FAULT IN ESTIMATING WARMTH.

No matter however carefully you cultivate the touch sense, it may be deceived. For example, if you take a penny and a piece of wood, and put them both into a hot oven, when they have both attained to the same heat you will upon touching them judge the coin to be much the hotter of the two. The metal parts with its heat much more readily than the wood, and on this account we judge it to be the

hotter. Suppose, again, we could take the coin and the wood and make them very much colder than ice, and each of the same degree of coldness. Upon touching them again with the hand, we should judge the metal to be the colder of the two, just because the warmth of the hand would be drawn away much swifter by the cold metal than by the cold wood. It is a well-known fact, too, that at very low temperatures indeed, such as exist around the poles of the earth, where quick-silver (the metal mercury) will sometimes freeze as hard as a stone, so far as hot and cold go our sense is reversed, for the Arctic traveller who unwittingly grasps his very cold iron gun-barrel with his bare hand will fling it away from him, because it seems to burn him, and blisters his hands just as a very hot one would do.

Try this very simple experiment:—Have three basins by you, one containing hot water, a second containing cold water, and a third containing lukewarm water. Place one hand in the hot water and the other in the cold for a sufficient time, and now bring both hands into the lukewarm water. The latter appears hot to the cooled hand and cold to the warmed hand. It is pretty evident, therefore, that you cannot trust the sense of touch to tell whether a liquid or anything else is of a proper heat, and for this purpose we have to employ the thermometer.

THERMOMETERS.

The instruments used for measuring heat are made of all kinds of shapes and material, according to the use they have to be put to; then, again, the degrees which are marked on them may be of very different value. We shall, however, use here, for the sake of simplicity, only one scale of degrees, the one universally employed by scientific men, and it is known as the Centigrade scale, because there are one hundred divisions between the freezing and boiling points of water. We shall describe how to make two instruments, the air thermometer and the mercury thermometer.

THE DIFFERENTIAL THERMOMETER.

The differential thermometer is comparatively easy to make. Take a piece of glass tubing about $2\frac{1}{2}$ feet long and of $\frac{1}{4}$ inch bore, and bend it six times in this way. The middle portion may now be filled, say, to the level of the dotted line by placing the end *b* in a vessel containing alcohol, coloured, say, with magenta, and then drawing up with

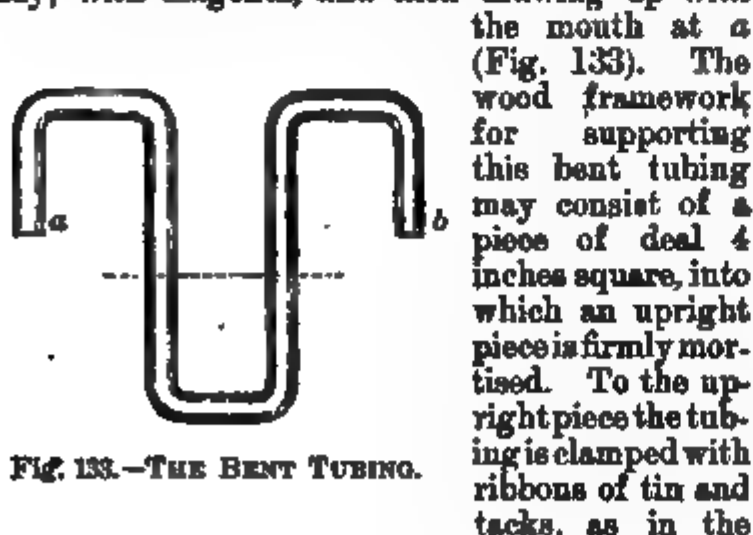


Fig. 133.—THE BENT TUBING.

the mouth at *a* (Fig. 133). The wood framework for supporting this bent tubing may consist of a piece of deal 4 inches square, into which an upright piece is firmly mortised. To the upright piece the tubing is clamped with ribbons of tin and tacks, as in the

Fig. 134.—A DIFFERENTIAL THERMOMETER.

diagram (Fig. 134). And now two small flasks are fitted to each end of the tube, and made air-tight with sealing-wax, so that the coloured alcohol is at the

same level on each side of the tube. A paper scale may now be gummed to the upright piece of wood.

If you now grasp one of the flasks with your warm hand the air within it will be expanded, the alcohol on its side will be pushed down by the expanding air, and the column of alcohol in the other arm will rise to a corresponding height. Now, in graduating the instrument you take the level of the alcohol in the two arms as zero on the scale, and having marked this off, you now dip both flasks into cups of water of a sufficient difference of temperature to make the alcohol on the cold side rise to the top of the arm, and in the other arm to the bottom nearly. Suppose, now, the temperature of the water in one cup is $40^{\circ}\text{C}.$, and in the other 20° , there is a difference of 20° , therefore the distance between the zero, or place of common level, and the top point reached by the alcohol is divided into twenty equal divisions, which represent the same number of degrees. You may further subdivide each of these degrees as far as you find it possible to.

HOW TO MAKE A MERCURY THERMOMETER.

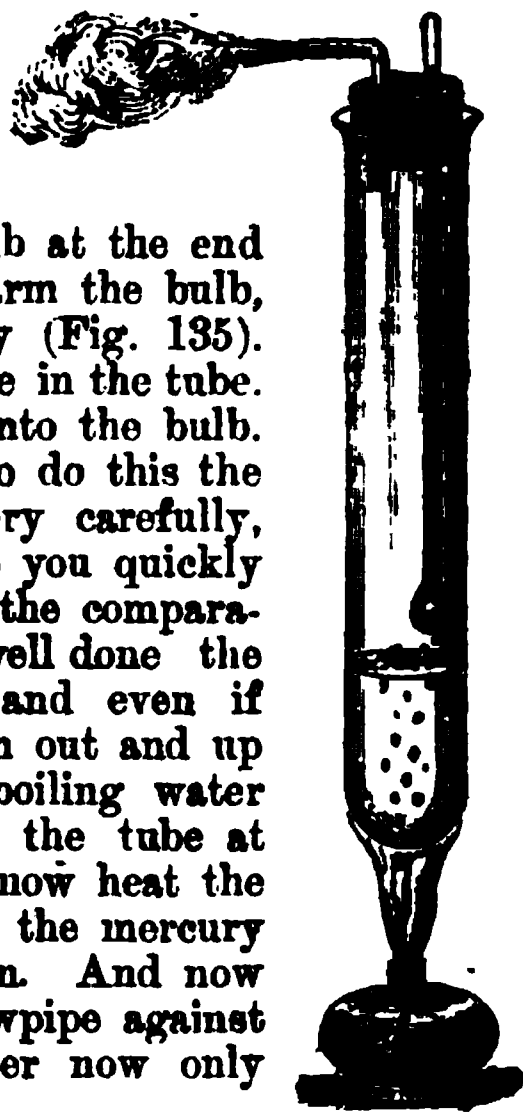
The ordinary thermometer is an instrument which is more to be trusted infinitely than the sense of touch when we want to measure a body's state of warmth.



Fig. 135. — FILLING A TUBE WITH MERCURY.

Why it is so will be more evident as we proceed; in the meantime, if you desire to make one, these are the instructions you must follow. You require first a piece of thermometer tubing of the usual minute bore, and a small quantity of dry clean mercury: indeed, to make sure it is dry you must heat it in a crucible nearly to boiling just before you commence to use it. All these operations with the mercury, both now and in any other case, must be conducted over the cardboard tray (p. 483), so that if any be spilled you

may readily gather it up again. Now blow a bulb at the end of the piece of tubing, and allow it to cool; next warm the bulb, and place the open end of the stem in the mercury (Fig. 135). As the bulb cools a small column of mercury will rise in the tube. It may now be inverted, and the mercury shaken into the bulb. Our object is now to fill the bulb completely, and to do this the small quantity of mercury in the bulb is boiled very carefully, and while vapour of mercury fills the bulb and tube you quickly and cautiously place the open end of the tube into the comparatively cold mercury. If the operation has been well done the bulb and tube will completely fill with mercury, and even if a bubble of air remain in the bulb it may be shaken out and up into the tube. You may now place the bulb in boiling water and notice how high the mercury rises. Narrow the tube at this point (p. 530), and after it is cooled you may now heat the mercury gently some distance above a flame until the mercury column rises half an inch or so above the constriction. And now you direct the tip of a small flame from the blowpipe against its narrow part, and seal it off. The thermometer now only wants graduating.



We have two points to fix on the stem experimentally: we have to ascertain, in the first place, where the mercury in the tube stands when the bulb and stem are immersed in a jar containing nothing but small bits of ice, so that the whole thermometer is closely

Fig. 136. — FIXING THE BOILING POINT.

packed in it; and in the second, where it stands when the whole thermometer is surrounded by invisible steam, not visible vapour of water. In ascertaining the lower point you may have a tightly-fitting ring of india-rubber around the stem, which may be pushed down and down until its edge just corresponds with the surface of the mercury in the tube, i.e., the top of the column when in the packed ice. Now make a slight scratch at this particular level with a file. To ascertain the higher point (Fig. 136), you may take a long piece of tubing of an inch bore, seal up one end, and into the other fit a cork with two holes in it, one for the insertion of our thermometer, and the other for a bent piece of tubing to fit in. Put some water into the tube, and then cork up. Boil the water, and while the steam is freely issuing from the bent tube the mark where the mercury in the tube stands may be slightly scratched: this is the boiling point of water. This latter point is called 100 degrees Centigrade (100° C.), and the former point, i.e., where the mercury stands in melting ice, is known as zero, or 0° C. Between these two points the stem must now be accurately divided into 100 equal divisions, and these divisions must be etched into the stem.

To etch Glass.—The readiest way is to procure hydrofluoric acid, which is kept in leaden or gutta-percha bottles. Your glass is now covered with a thin coating of beeswax, and the writing or measurements are carefully scratched in the wax, so as to leave the glass bare. When this is done to your satisfaction a strip of blotting-paper is cut sufficiently large to cover the writing, and this is laid over the parts to be etched and carefully saturated with the hydrofluoric acid solution. Be careful in handling the bottle containing the hydrofluoric acid, for if you get any on to your skin dangerous sores may be produced.

Another method of etching is that described on p. 542, when the hydrofluoric acid is made during the etching process.

To make a Tray for working with Mercury.—In all experiments where mercury has to be used, it is just as well to have a cardboard tray, so that if any of this metal be spilled (and it is not inaptly called quicksilver) it may be readily gathered up again. To make the tray take a sheet of cardboard (*a b c d*), about 2 feet long and 2 feet broad. Parallel to each edge (Fig. 137), and two inches off it, draw dotted lines, and cut through the cardboard where we have drawn the deep lines. Now bend the cardboard all along the dotted lines so as to form the sides of the tray, and bend the corners round, and then glue them fast. A tray is now obtained two inches deep, which may be used when thermometers, barometers, or other instruments are to be made where mercury is employed.

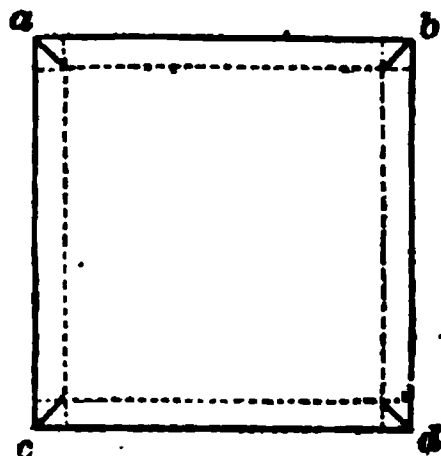


Fig. 137. — MAKING A MERCURY TRAY.

THE THREE STATES OF A SUBSTANCE.

The commonest substance on the face of the earth is water, for the greater part of the globe is covered with it, and even on what we call dry land we have wells, rivulets, and rivers, which supply us with all we want. Yet although, the most common, it is probably the most interesting, and it undergoes changes which are representative of alterations that take place in a host of other substances. Water, for example, exists in the solid form as ice or snow, and vast regions at the two poles are for ever covered with it. Mountains of ice from these regions are sometimes borne by ocean currents even into our own latitudes, and beautiful as they may seem in daylight, with their pinnacles of

every hue of the rainbow, they are a source of great danger indeed to the mariner, who in the darkness of night may steer straight into them and become wrecked.

Water exists also in the liquid form. We need scarcely say it, for as we have before observed, it is ever present with us in this form in our oceans, seas, lakes, and rivers, and covers nearly three-quarters of the face of the earth.

Water exists, too, in the gaseous form, as gaseous as the air we breathe or the carburetted hydrogen we burn at our gas-jets. The gaseous form of water—steam—is produced whenever water is boiled, whether at home in our kettles or at the factory in large boilers. Immediately this invisible steam is condensed it is made visible to us in an ascending white cloud of minute water particles.

If, then, you were to take a lump of ice and put it in a kettle, the heat of the house-fire would transform it into liquid water, and now, if you were to continue the heating process the liquid water would be transformed into gaseous steam. These, then, are the three forms of water—solid, liquid, and gas. We must now enter somewhat more minutely into the history of the change from any one form to another, for if you have not read this history there are many interesting operations going on incessantly at every spot on the earth which you will be unable to understand.

Ice is lighter than water; a conclusion which may be drawn from this fact.—Whenever you throw a stone into water it sinks, because, bulk for bulk, it is heavier than water; but when the substance you throw in is lighter than water—be it wood, cork, or bread for the little fishes—it floats, because, bulk for bulk, each of these substances is lighter than water. Any substance, in fact, which will float in water is lighter than it. Ice, as you are aware, floats on water, therefore ice is lighter than liquid water. All this is as clear as noonday, and may, moreover, be proved by taking equal bulks of these substances and weighing them, when the experimental results will tally completely with what we have said.

How is it, then, that a certain measure of water just before freezing weighs more than an equal measure of ice just frozen? We can only give one reply to this question, think as we may, and that answer is, that during the change from water to ice there must have been sudden swelling out or expansion. Here is a simple proof that it is so:—A stoneware bottle filled up to the neck with water and corked was left out in the cold one winter's night. In the morning the bottle was seen to be broken in two, and inside the upright half there was a perfect model in ice of what had been the interior of the bottle. Now, one has no occasion to wait for a night in December or January to repeat this experiment, for you may do it in the middle of July. Fill a bottle up to the top with water and cork it very tightly. Finely powder some ice, which in these days you may procure cheaply from any respectable fishmonger, and mix with the ice a quantity of common salt. Inside such a mixture there is as great a degree of cold as there is on any of our winter nights, and upon packing the filled bottle in the mixture all the water inside it is frozen and the bottle riven asunder. The bottle may be made of cast-iron and plugged with an iron screw, and it will still be rent during the freezing of the water within it. It is plain that if the water filling the bottle had shrunk in bulk, or even kept of the same volume, there would have been no cracking, but the very fact of the bottle breaking shows that what we argued out is true, namely, that when water changes from the liquid to the solid form there is expansion.

You have often walked after a frost along a country footpath, faultless of flags or sets, or anything of that kind, and if a thaw had set in under the influence of the sun's rays you know that the path was simply unfit to walk on, your shoes

being weighted with slush every time you lifted them up. It came about in this wise:—The ground was moist when the frost commenced, and as each water particle was frozen it thrust asunder the bits of earth it was lodged between. But this water particle was only one of myriads, each suffering the same change with the same result. When, therefore, the frozen particles were melted all the bits of earth forming the path were loosened, and being wet with the newly-formed liquid, there was formed the slush you detested.

The breaking of an iron bottle gives you some idea of the enormous force exerted when the expansion takes place, and a great work is accomplished by this process of freezing—that work being no less than the wearing down of the earth's surface. For water lodges everywhere, and must, during the changes from liquid to solid and from solid to liquid again, break down the surfaces of rock, and thus furnish much of the sand our rivers carry forward to the sea (p. 570).

As you grow older and mix more in the world you will find among men the greatest diversity of character, and if you take any particular quality which one of your acquaintances possesses in a remarkable degree—let us say generosity—you will also find the same quality possessed by a good number of other people you are acquainted with. It is pretty evident to you, however, that if you could construct a scale of generosity and mark off on this scale the amount of generosity which each one possessed, you would find every gradation, between the friend so remarkable for it and the acquaintance who had scarcely got any. And so it would be with every other quality; and a person's individuality arises from the sum of the qualities he possesses in such various degrees. Now as with men so it is with things. If any peculiar substance you take hold of has a quality for which it is especially noted, there are besides a number of other bodies which have the same quality, only in a less degree. If, then, you ever come across a substance with some peculiar quality you may make quite sure that a rigorous search among other bodies will reveal some which possess the same property, only it may be to a less degree. Here, for example, is this water we have been speaking of, which expands when it solidifies. Is there any other substance which does the same? For a long time it was thought that there was no such substance, but now we know that bismuth behaves in the same way, for if you were to fill an iron bottle with molten bismuth the bottle would be shattered when the bismuth solidified.

THE CHANGE FROM ICE TO WATER, AND FROM WATER TO STEAM.

When ice is melted we reverse the order of operations, and we have contraction—in other words, a pint of ice will produce less than a pint of water at the same temperature. What we have more particularly to note here, however, is this: that the thermometer you have in the melting ice never shows any change of temperature—the mercury keeps at 0°C . continually, as long as the last bit of ice is unmelted. It is for this reason that when you want to fix the zero point on a thermometer you pack it in melting ice (p. 483).

Now this constancy of temperature is also shown when water is being changed into steam by boiling, for you may heat water as long as ever you like, and you will not change the temperature of the steam coming off so long as there is any water to boil. And this temperature is at the point we agree to call 100° on the Centigrade thermometer. It is this constancy of temperature exhibited by steam above the surface of boiling water that makes us employ it for getting one of the fixed points of our thermometer, one of its landmarks, so to say, and highly convenient it is for the purpose, as we have seen that with simple and inexpensive apparatus (p. 482), one may readily obtain the fixed point.

THE WATER-HAMMER.

One of the first effects observed upon heating a flask full of water is the

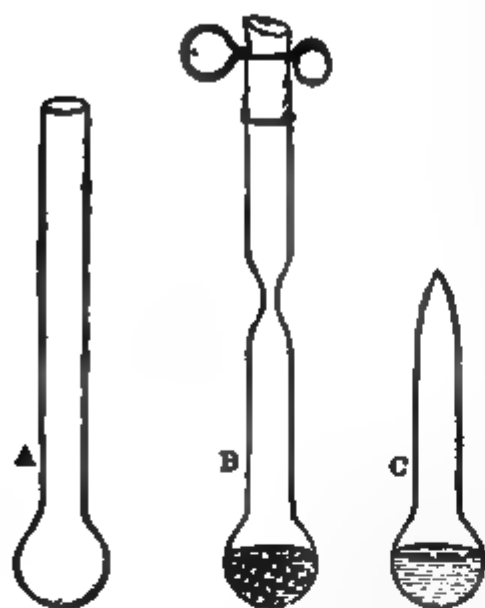


Fig. 138.—MAKING A WATER HAMMER.

collection of minute bubbles at the sides, which rise to the surface without noise. These are bubbles of air, which the water held in solution when cold, and when the water is boiled all this air is got rid of. The air acts as a sort of cushion when lodged in solution among the water particles, and seems, in fact, necessary for the regularity of some of the phenomena we are accustomed to study in water. Thus, for example, water which has been deprived of its air may be heated as much as 80° C. above its ordinary boiling-point, when the steam will escape with extraordinary violence. This is a matter of some practical importance, as boiler explosions have undoubtedly often occurred when the water has been kept warm for several days previous to work being commenced, and they might have been prevented by having a slow stream of fresh water passing into the boiler all the

time. Water which has been deprived of its air also emits a clicking metallic sound when shaken, which ordinary water does not. An instrument for showing this fact is called the water-hammer, and may easily be made.

A piece (Fig. 138) of glass tubing (A) has a bulb made at one end. The bulb is now filled with water, and the upper part of the tube narrowed, as in B. The open end has a piece of india-rubber tubing next fitted on to it with a clip, which may easily be opened and shut. If now the water in B be boiled, all the air is driven out along with the steam while the clip is pressed, and upon letting go of the clip you must bring the tube quickly to the blow-pipe, and seal up the thin portion of it with a small and sharp blow-pipe flame. We thus get a finished bulb (C), containing water deprived of its air, and upon shaking it up you will hear a metallic click, whence its name of "the water-hammer."

Fig. 139.—SMALL STEAM ENGINE.

THE STEAM-ENGINE.

When gunpowder explodes the black solid material is changed in great

measure into gases of very many times the bulk: hence, if the powder be confined there is a great push on all sides of its prison as soon as the change takes place. This enormous push we make use of for sending balls out of cannons and for breaking up rocks in quarrying operations. Similarly, when liquid water is changed into steam in a confined cavity, such as a boiler, the steam produced, being 1,650 times more bulky than the water from which it is formed, presses against the sides with great force. Roughly speaking, one cubic inch of water expands into one cubic foot of steam under ordinary circumstances. Now this pressure, which is produced when water is turned into steam, is utilised in the steam-engine. There are many kinds of engines, according to the use they have to be put to, but all of them have certain parts in common; therefore, instead of wearying you with a description of them all, we shall only describe the one represented in Fig. 139, which, by the way, is from a photograph of a small engine made by a boy.

The framework consists of a stand of wood, upon which two cast-iron triangular supports are firmly bolted. On the top of these are brass pedestals for the ends of the axle bearing the fly-wheel (*f*), and two eccentrics, one of which is seen at *e*. From the diagram you will perceive that this is a sort of double engine, and therefore a description of one side will answer for the other as well. Let us see first, then, how the steam performs its duty when passing from the boiler or kettle.

The steam is first made to enter the closed cylinder (*c*, Fig. 140), which is made of cast-iron, and has its barrel so nicely turned that a sort of plug (*p*), called the piston, can be worked up and down steam-tight. The steam is made to push this piston upwards and downwards, and this is the movement which the other parts of the engine are designed to modify, regulate, and utilise. How is the up-and-down motion given to the piston by means of the steam? This is generally regarded as a difficult point by boys; but we are sure you will understand it by a little patient reading and thinking.



Fig. 141.—APERTURES IN THE CYLINDER AND HOLLOW IN THE D VALVE.

The steam coming from the boiler along the pipe (*s p*) enters a box (*b b'*). The inside of the cylinder communicates with this box at top and bottom (*a a'*). Let us imagine the cylinder to be fairly cut in two, in a direction such that the principal parts are bisected. On the side of the cylinder next to the steam-box the two openings (*a a'*) we have referred to will be seen; there is also a section

of a pipe (a'), which puts a or a' in communication with the outside air, but never with the steam-box ($b b'$). This is managed by means of a peculiar valve (D), which works up and down, and in the position represented in the diagram it has now shut a' completely off from the steam-box, so that the lower portion of the cylinder is in communication with the outside air by means of the pipe at a'' , while the upper portion of the cylinder is just being placed in direct communication with the steam-box and boiler. The cylinder is, therefore, being pushed downwards, and the steam in the lower portion is passing out into the air through $a' a''$, so as to offer no opposition to the down progress of the piston. To see more clearly the action of the valve, which is called a D valve, suppose yourself in the steam-box with the valve D removed: you observe three openings (Fig. 141), a leading into the top part of the cylinder, a' to the bottom of it, and a'' to the outside air. Upon examining the D valve itself, you also see that it is hollowed out on the face turned towards the holes, and the hollow is of such a size that it cannot cover more than two at once. The uncovered hole is in communication with the boiler, and the two covered ones make, with the hollow in the valve, a sort of pipe, placing the cylinder on one side of the piston, in direct communication with the air outside. This valve, then, in working up and down, permits the steam to go first in at one end of the cylinder and then at the other, and at whichever

Fig. 142.—WORKING OF THE CRANK.

end it permits the steam to enter it simultaneously shuts it out from the other, and, moreover, places it in communication with the outside of the cylinder, so that the steam may escape and offer no resistance to the movement of the piston.

Upon now turning to the diagram of the complete engine, you will see some of the parts we have described. The steam-pipe (s , Fig. 139) conveys steam from the kettle or boiler, and branching off at t , sends a supply of steam to each cylinder. At b you have a view of one of the steam-boxes, and you can likewise see the pipe which conveys steam to the open air from either half of the cylinder, according to the position of the D valve.



Fig. 144.—ECCENTRIC CLIP.

There is a special contrivance for turning the up-and-down motion of the piston into a circular motion (Fig. 142). The piston has a rod (p) fixed to it, which passes through the top of the cylinder. A connecting rod (r) is attached to the piston-rod at one end and to the crank (c) at the other, so that when the piston-rod is pushed upwards and downwards it gives a rotating motion to the axle at a . It is, in fact, a precisely similar arrangement to that figured on p. 478. The crank is apt to be unsteady, and the ponderous whirl of the heavy fly-wheel (f) keeps it at a regular pace.

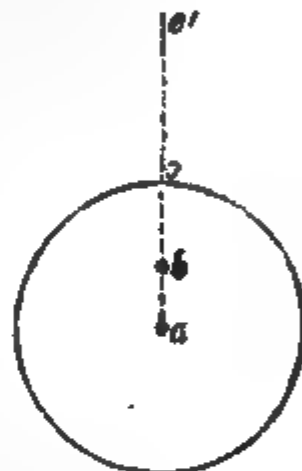


Fig. 143.—ILLUSTRATING ACTION OF THE ECCENTRIC.

The next part we have to study is the eccentric, which you will clearly understand by cutting out a circle of cardboard. If you stick a pin through it at a for an axle (Fig. 143), so long as the axle keeps steady and in one position the distance of the top portion of it (c) will always be the same from the centre; but if, on the other hand, you stick the pin in at b , out of the centre (*eccentric*), the top portion of the rotating card will constantly alter its level from c to c' ; there will thus be produced an up-and-down motion through the distance cc' . If, therefore, you have a strap hanging round the card rotating in this fashion, the strap will rise and fall. Just so it is in the eccentric (e , Fig. 139). A circle of iron, with a hollow rim, has the axle passing through it out of its centre. In the hollow rim two half rings of brass fit, and are fastened together by screws; to the bottom one a rod is fixed, and the movement of the eccentric gives this rod an up-and-down motion (Fig. 144). This is the up-and-down motion which keeps the D valve moving in front of the holes we have described.

Extending from the bottom of each cylinder there is a pipe with a tap; one of these sipping pipes, with its tap, is seen down at the right-hand side of the stand in Fig. 139. When you are going to start the engine, the sipping tap (of each cylinder) has to be opened, so that any water which has condensed in it may flow out. With the sipping taps still open, connect the pipe (s) to the boiler or kettle, and turn the tap (t), so that steam can flow into the boxes and cylinders and issue from the sipping taps. When the parts have acquired a requisite temperature, steam alone will come out of the sipping pipes, and their taps may be shut off; and now the fly-wheel will spin merrily round, and the little machine will appear animated with a desire to work. You may exercise your ingenuity in making it rock a cradle or turn a sewing-machine.

And now, as to making an engine: you will certainly require the co-operation of some intelligent friend mechanic, as you have to prepare models of cylinder, piston, crank, and connecting rod, D valve, supports, &c. If you have a lathe, and know how to use it, the turning and drilling you may, perhaps, manage for yourself. The dimensions of the engine in Fig. 139 are as follows:—

Wooden bottom	...	12 in. × 18 in.
Height of supports, without the brass bearings	...	9 inches.
Distance of supports apart	...	7 "
Length of axle bearing fly-wheel and eccentrics	...	8 "
Diameter of fly-wheel, outside measurement	...	10½

THE PHILOSOPHY OF BOILING POTATOES.

We fancy we can hear you say that the philosophy of boiling potatoes has no interest for you, as you are no cook. It is possible, however, to show that such an operation is an exceedingly interesting one; and, to commence with, could you answer these questions straight off?—1. Why cannot one cook potatoes in boiling water on the top of Mount Blanc? and 2. Why does the housewife throw a handful of salt into the pan when she is going to boil potatoes? We can quite understand that the first question floors you; but to the second you hastily reply, "Why, of course it is to make the potatoes tasty." This, it need hardly be said, is one of those hasty guesses we have already deprecated.

When we said that water boils at 100° C., we meant that it does so at the ordinary atmospheric pressure, that is, when the barometer stands at a certain height, as will be explained further on (p. 564), and, moreover, when the water is pure. But since it can be shown that under other circumstances water boils at a different temperature, it cannot fail to interest you to know what some of those circumstances are, and it will be as well, in the first place, to inquire what this boiling really is.

You know, of course, that when water is heated over the fire in an open

kettle that it grows hotter and hotter, and that steam begins to come off. When it has reached a certain temperature "the kettle sings," and at a higher temperature still the water boils. Now, if you performed this heating operation in a glass kettle you would see what was going on inside. You would observe bubbles of vapour formed on the bottom at a certain stage of the heating, and these would rise, but before coming to the surface they would be condensed by colder water, and thus give rise to the "singing." This is precisely similar to what happens when one turns a jet of steam into cold water: it is condensed with a great noise. But the water in the kettle or glass vessel is in the meantime growing hotter, and at last a point is reached when the bubbles can rise to the surface without collapsing. Now the water boils; and at this point the steam in each bubble exerts a pressure against its sides equal to the pressure of the atmosphere, viz., about 15 lbs. per square inch. It is when the pressure of the steam equals the external pressure that water boils, from which you will perceive it follows that if the atmospheric pressure be reduced the water will begin to boil at a lower temperature than 100°C ., and if the pressure of the air be made more than the ordinary 15 lbs. to the square inch the boiling-point of the water will be raised.

Now when you go up a mountain, you have, as you ascend, a less and less weight of air pressing down upon you, so that when you boil water on the top of Mount Blanc it only requires a temperature of about 85°C ., because at this temperature the bubbles of steam are able to overcome the decreased pressure of the atmosphere and other obstacles to their formation. But a heat of 85°C . would certainly be insufficient to cook the potatoes to your liking, so that if you wanted

them nice and soft you would have to boil them in a closed vessel, where the pressure could be raised to 15 lbs. or more per square inch. To show that water will boil at a lower temperature than ordinary when pressure is lightened, you may try the following interesting experiment.

WATER MADE TO BOIL UNDER THE SURFACE OF COLD WATER.

Take a flask and boil some water in it (Fig. 145). Now while steam is still issuing from the mouth of the half-filled flask cork it up tightly. When it has ceased to boil immerse it in a bowl of water. The water within the flask, although at a lower

Fig. 145.—HOW TO MAKE WATER BOIL UNDER COLD WATER.

temperature than before, will now commence to boil again. And this is the reason:—Upon immersing the flask in the cold water the vapour was condensed, and the pressure on the surface of the water within it was therefore very much reduced, and the water was able to boil again. It was, in fact, as if you had boiled the water in the open air, and then quickly removed the greater part of the atmospheric pressure by means of an air-pump, or by transporting it immediately high up into a mountain. Either of these operations would reduce the pressure, and thus allow bubbles to form rapidly again within the heated water. In one experiment the same end is attained by liquefying the steam, i.e., reducing it $\frac{1}{10}$ in bulk, so that the remaining water-vapour presses lightly on the hot water.

SUBSTANCES IN THE WATER ALTER THE TEMPERATURE AT WHICH IT BOILS.

If you now take some water and put a handful of carbonate of soda into it, you will find that when it boils its temperature will be about 104°C . Many other substances have the same effect; for example, sal ammoniac, nitre, and common salt. Upon experimenting with water in which you have dissolved as much common salt as it will take up, you will find that when this solution of common salt boils the temperature will be about 108°C ., or 8° over the ordinary boiling temperature. Does it not, therefore, appear highly probable that putting common salt into the pan where the potatoes are, is to raise the temperature so that the potatoes may be well cooked? Would it not seem likely that some dame in times gone by, using salt with the idea of savouring the potatoes, found them by such treatment nicer and softer than usual, for which reason she kept up the method, and communicated it to her neighbours?

BOILING-POINTS.

The temperature at which a substance boils is called its boiling-point. Different substances have very different boiling-points: thus, while pure water boils at 100°C ., mercury only boils at 350°C ., and ether at as low a temperature as 35°C . You will, therefore, easily see that if a liquid be poured into another whose temperature is higher than the first's boiling-point, it will instantly be converted into gas.

AN EXCITING INCIDENT.

Strange things sometimes happen where youths are congregated together pursuing their studies, but one of the strangest we ever remember partook of the nature of an accident. It was in the laboratory of the Royal College of Chemistry, some years ago, that a student was engaged in melting paraffin, as he required a temperature higher than that of boiling water, and you may raise melted paraffin to 200°C . without inconvenience, as it does not boil until it has reached a much higher temperature. He was conducting the operation in a kind of square box or cupboard, with a chimney leading from the top of it, in which was a gas-light to induce a draught. Such boxes are employed when disagreeably-smelling operations are being carried on, as you can put the apparatus within the box and close the glass door, all the stinking vapour passing up the chimney.

Our student went on heating his paraffin, which was in a pan, until it was not far off its boiling-point, and vapour rose from the surface and proceeded in a stream towards the chimney. Suddenly the whole panful of paraffin was in a blaze; the vapour, passing the light in the chimney, had caught fire, and the blaze had then swiftly travelled to the paraffin in the pan. It was, in fact, a repetition of the candle experiment (p. 549) on a large and inconvenient scale. While student No. 1 rushed away for something wherewith to put out the large blaze, student No. 2 comes hastily up with a bottle of water, and attempts to throw it on the paraffin. Matters were bad before, but now they were far worse. The whole cupboard became a mass of flame, and if No. 1 had not, by a kind of inspiration, pulled down the sliding door, and thus shut off the air, probably the building might have been burnt down. Instantly water was sent on to the paraffin it was converted into steam with nearly explosive violence, and burning paraffin was thus scattered right and left over the woodwork. These same students ignited paraffin many a time after that, but they put it out by covering the pan with a thick cloth or something that deprived the paraffin of air, and so quietly smothered it.

This mixing of water with a liquid whose temperature is above 100°C . is the cause of the noise you may have heard when the cook in some roasting or frying

operation has added water to the hot and liquid fat; the water has instantly been converted into steam with a loud hissing noise. We have next to see what happens when solids are heated.

HOW TO MAKE A LEVER PYROMETER.

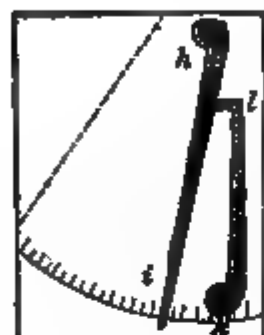


Fig. 146.—INDEX OF PYROMETER.

This is a simple contrivance for showing how a long bar of metal lengthens when you heat it with a flame of any sort. You require, in the first place, a piece of wood (*a b c*) about sixteen inches long and four inches broad—this is the stand on which you have to build the remainder of the instrument (Fig. 147). Two upright pieces of wood (*d* and *e*) are now wanted, about six inches long each, *d* being about three inches broad, and *e* being about as broad as long. These have to be firmly fitted into the stand. On *d* a binding screw is now placed, so that one end of a bar of metal, say copper, may be screwed tight in it. The other end of the bar passes loosely through a round hole in a metal knob similarly fixed to the upright piece of wood (*e*). It will be seen now that if the bar lengthens when heated by running the Bunsen flame (*l*) along its length, the end *f* will be thrust forward through the round hole, while it is fast at the end *g*. We want now some device for detecting readily this movement of the end *f*, and this brings us next to the cardboard portion of the arrangement. Take a piece of cardboard about a foot long and nearly a foot broad, and with centre (*h*) describe an arc of a circle along the bottom edge (Fig. 146). Cut off the corner portion outside this arc and also the portion along the dotted line, and next graduate the arc as fine as you like. A pointer must now be made out of sheet zinc or other likely material, and it must be of the shape *k i*, and when finished it must be attached by a pin at *h*, so that it can freely move and describe an arc with its end *i*. And now a lever, also of zinc, may be cut out and filed of requisite shape, like *k l*, being, moreover, fixed in the same manner by a pin at *k*. This cardboard, with its pointer and lever, has now to be attached to the upright piece of wood (*e*), so that the end of the bar (*f*) may be in contact with the lever (*k l*).

The pyrometer is now complete. Upon heating the bar of metal by moving the flame of a candle, or, what is cleaner, of a spirit-lamp or Bunsen burner along it, it lengthens out, and as it cannot move at the end *g*, it pushes forward at the end *f*, where it is in contact with the lever. Now, the latter is only able to

Fig. 147.—LEVER PYROMETER.

move at one end (*l*), and does so readily, pushing the pointer (*h i*) before it, and thus the lengthening of the bar of metal is rendered evident to the eye by the pointer describing an arc of many degrees.

As you will perceive, the cost of material here is next to nothing, whereas, if you buy the instrument it may be close upon half-a-sovereign, without being a whit better in its performance. The experiment serves most forcibly to show that metal bars lengthen under the influence of heat, for if the bar be, say, of copper, you will scarcely have heated it half a minute before the pointer has gone through half the arc.

EXPANSION.

When heat enters a substance it, as a very general rule, makes it grow bigger, or expand: thus we have seen that when a mercury thermometer is placed in a warm fluid the mercury begins at once to take up more room, so that it rises in the stem, and it does so sufficiently uniformly for us to make it a measurer of temperature. We have seen likewise, by means of the lever pyrometer, that a bar of metal lengthens when it is heated. Every civilised country is now bound together, as it were, by long bars of metal, end to end, which extend for hundreds, or may be thousands, of miles: we refer to the rails on which our locomotives travel. Suppose, then, that these bars were tightly fixed end to end by the platelayer, so that you could not bring the edge of a penknife between them, you will easily perceive that the difference between a frosty morning and a comparatively warm noon would cause them to expand, and the expansion would amount to the insertion of over a foot of rail in a mile of them if the alteration of temperature were only 20°C ., so that between two villages six miles apart you would have a lengthening out to six feet more. Something would evidently have to give way, and probably the sleepers would be torn up.

But when most substances are heated they expand in every direction, and the following simple device is designed to illustrate this. A rod of brass (*A*, Fig. 148), is made of such a length and such a diameter that it will just fit lengthways in the gauge *B*, and it will also go into the hole *C*. But if you now put the brass cylinder into the gas-flame for a few seconds, and thus make it very much hotter than the gauge, you will find that it has grown too big either to be put into the hole *C* or go into the socket *B*. Heating has made it bigger, not only in length, but in breadth also. And so it does with most substances.

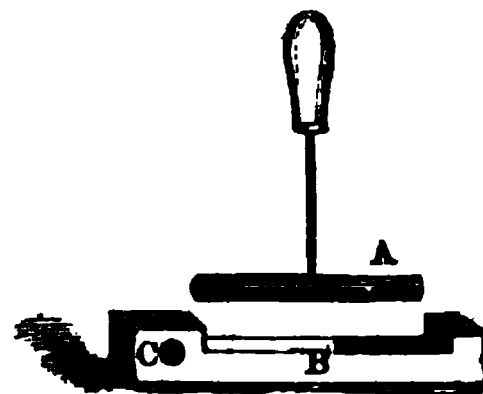


Fig. 148.—DEVICE FOR DETECTING EXPANSION.

Advantage is generally taken of this fact in fitting iron tires on to cart and carriage wheels. The tire is first made red-hot in a ring-shaped fire, and now while the iron is in its expanded state it is fitted on to the wooden framework, and rapidly cooled with cold water. In cooling it clasps the wood-work very tightly, so that it is ready to bear all the wear and tear it may be subsequently subjected to.

We have now seen what happens when gases, liquids, and solids are heated; let us next inquire how heat is imparted to them.

THE CONDUCTION OF HEAT.

When water is heated in a kettle the heat of the fire reaches the water by means of the iron or copper of which the vessel is made. This passage of heat from the outer surface of the kettle in contact with the fire to the inner surface in contact with the water is termed *conduction*.

In the following experiment we shall at once be able to see the precise

meaning of conduction, and at the same time that different substances are very unlike each other in conductivity.

A metal trough is furnished with a number of round holes in one side, into which corks are fitted (Fig. 149). Through each cork a hole is bored, so that equal rods of copper, brass, iron, lead, wood, and glass may be passed. Each rod is now dipped in melted wax or tallow, and withdrawn so that a thin film of the substance may extend from the free end of each rod up to the corks. The rods are now placed in position, and the box is filled with hot water. Now, when each of the rods has got to a permanent state of heat, i.e., when its temperature is constant, it will be found that the wax is melted farther along some of the rods than along others, which shows us that the

Fig. 149.—EXPERIMENT IN CONDUCTION.

melting temperature of the wax has been able to get farther along some than others. Copper is the best in this respect, next comes the brass, and the wood and glass are last. Whatever this heat may be, then, it is apparent that it flows along copper, or is conducted by it better than by any of the other bodies.

PRINCIPLE OF THE DAVY LAMP.

Curious effects may sometimes be noticed which result from conduction of heat. Sometimes, for example, when a paraffin-oil lamp has been lit, and you are turning down the wick, the flame seems to split off and float over the brass top (Fig. 150), which very evidently arises from the brass conducting the heat away from the flame so fast that it is put out for a certain distance above the aperture. You may just in the same way put out the flame of a candle by bringing over it a coil of thick copper wire, which conducts away the heat so quickly that the temperature is reduced below the firing-point of the tallow or wax vapour.

Fig. 150.—FLOATING FLAME.

Another very instructive experiment of this sort you may try with wire gauze. Turn on the gas and hold a sheet of gauze over the jet. You may now light the gas which is streaming through the meshes of the gauze, and you will find that when you light it above the gauze the gas below it does not ignite. The metal wire conducts the heat away too fast for this to happen. It is this fact which makes the Davy lamp safer for miners than bare lights, for a bare lamp would ignite the fire-damp, but in the Davy lamp the light is screened by wire gauze (Fig. 151), so that if the fire-damp is even wafted against it the outside gas cannot ignite, because the gauze conducts the heat away too quickly.

ICE CONTAINED IN THE SAME VESSEL AS BOILING WATER.

Fig. 151.—THE DAVY LAMP.

Now, liquids are extremely bad conductors of heat, and the following is a simple illustration of the fact, so far as water is concerned (Fig. 152). If you take a test tube (a b), and fill it with water, you may grasp the lower part (a) while you hold the upper portion over a spirit-lamp flame (c). The water at the top end soon begins to boil, but you experience no inconvenience at a. Far otherwise would it

have been had this been a bar of metal instead of a column of liquid, for your fingers would soon have been burnt and blistered; but now the portion of water at *a* feels quite cold, from which you may infer that water is an exceedingly bad conductor.

You may make the experiment a little more striking by taking a bit of ice and wrapping round it a strip of lead or other metal, so as to be able to sink it to the bottom of the tube before commencing heating. Such a piece of ice will remain at *a* for a long time before it is melted, even although the water above it at *b* is boiling furiously and sending off volumes of steam. Plainly, then, little or no heat has been conducted along the fluid from *b* towards *a*.



A RED-HOT BALL HELD IN THE HAND.

Gases, like the air we breathe, are very bad conductors; it is, however, a difficult thing to show this, for any result one might obtain as due to conduction might be looked upon as owing to radiation (p. 496). Thus, for example, if the

Fig. 152.—ICE UNDER BOILING WATER.

top of a column of air was heated in some way like the column of water in the preceding paragraph, the radiant heat would affect anything in the bottom of the tube, and this substance would then give rise to convection currents, so that any share in producing the final effect that conduction might have would be exceedingly difficult, if not impossible, to pick out. Count Rumford made a lot of experiments, in which these heated currents of air were retarded considerably in their movements by placing between the giver and receiver of heat a layer of wool or other fibrous substance. But it was found that the transmission of heat was considerably retarded; from which it follows that if air has the property of conducting heat it possesses it only to a very small degree. You may employ asbestos, just as Rumford employed down and wool, and as it is an inorganic substance, you may experiment at very much higher temperatures than he did.

You will find that if you place a layer of this fibrous asbestos on the palm of your hand, you can now hold a red-hot ball on it comfortably (Fig. 153).



Fig. 153.—HAND HOLDING RED-HOT BALL.

HOW GASES AND LIQUIDS ARE HEATED.

We have already spoken of convection currents, and it is by such currents that bodies of air or water become heated. This you may easily prove in the case of water, for if you heat some water in a glass vessel, and have bran in it, the water which rises from the hot surface carries the bran with it, and by means of the bran you are able to see the hot portions of water rise, and colder portions fall to get warmed, and so on. This same process at work heats vast bodies of air, for after air has been heated it rises, colder air takes its place to be similarly heated, and so the operation goes on. There is another case of the imparting of heat where neither conduction nor convection is at work, where the heat passes through vast regions in minute spaces of time before it reaches the body which drinks it in; this process of giving off heat is known as *radiation*.

THE HEAT FROM A POKER.

When you have a poker red-hot, heat is passing from it in several ways. We already know, for example, that the air around becomes hot, and carries the

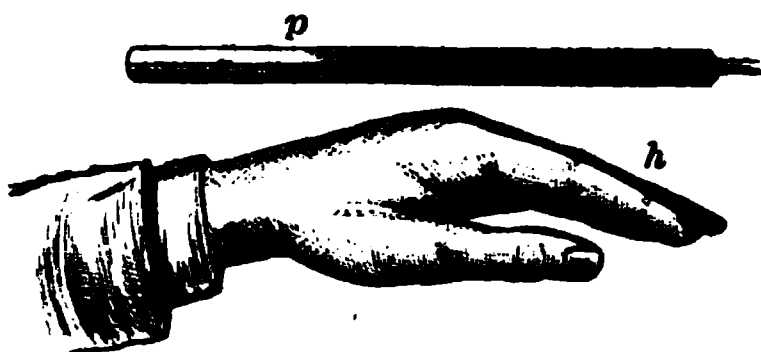


Fig. 154.—HEAT OF POKER.

heat away in the convection currents which are produced, and fresh supplies of cold air come in to supply the place of the uprising warm air, and these in their turn become heated, and so the movement is carried on. This, then, is one important way in which heat is carried from the hot poker; it is not the one we are seeking, however.

Again, there is a regular flow of heat, so to speak, from the hottest portion of the poker to the colder portions, and in this conduction we have a ready means for the heat of the iron to pass away to anything with which it may be in contact. But even this source of loss is not so important as what we now come to. If you hold your hand below the poker you will feel that heat is passing from it in some way, for you are sensible of the warmth. Heat, then, is passing from the poker in a way which is different from conduction, because the air between the poker (*p*) and the hand (*h*) conducts no heat to the hand (Fig. 154), but the hand is rather kept in contact with the cold currents of air coming to supply the place of the ascending warm currents, which take their origin just about the sides of the poker. Nor is the warmth felt by the hand due to warm convection currents, as one might have supposed had it been on the upper side of *p*. This process, then, by means of which the hand is warmed is different from either conduction or convection, and it is named *radiation*.

The radiation of heat from a hot poker is exactly the same in its nature as the radiation of light from a burning substance, so that whatever we can do with the one we can do with the other. Hence radiant heat may be absorbed when it falls on to the surface of a body, or it may be reflected, or it may be refracted. It will pass through a vacuum just as light will, and as it comes from the sun to the earth and the rest of the planets, it must pass through a vacuum or empty space more perfect than we can make.

THE DRINKING IN OF RADIANT HEAT.

When the hand was held under the poker, as we have just described, there was evidently an absorption of heat by the skin, or our nerves would not have been affected so as to produce the sensation of warmth. If the blackened bulb of a thermometer had been held in the same place it would have indicated a rise in temperature directly, so that when heat is drunk in or absorbed by the surface of a body some effect generally follows which makes us aware of the fact. Thus the drinking in of heat by the earth's surface gives rise to convection currents, and in the radiometer we have a wonderfully delicate instrument, which shows us not only that a mechanical effect follows the absorption of heat, but also that this effect varies with the nature of the surface drinking in heat (Fig. 155).

The radiometer consists of a glass vessel, which has been emptied of air as well as ever the best available means will permit. But after the most perfect

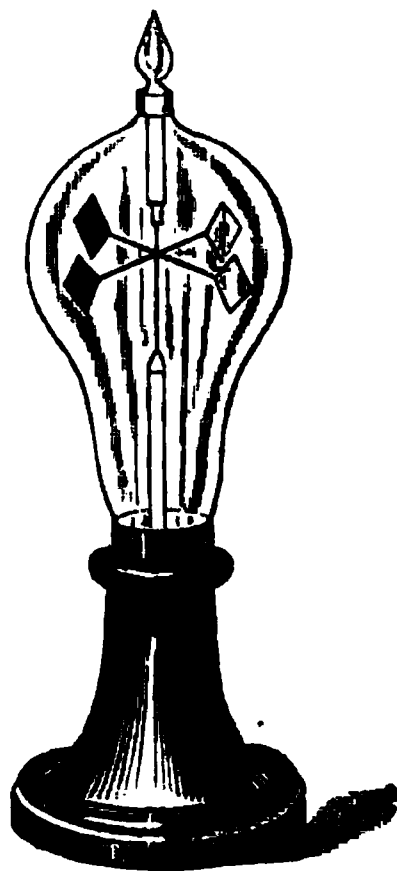


Fig. 155.—THE RADIO-METER.

exhaustion at the air-pump there is still a great number of air particles left in the glass vessel, and these are flying about in the glass chamber at a tremendous rate. Vanes are very delicately suspended in this apparatus, so that the slightest impetus will send them spinning round. One surface of each vane is blackened and the opposite face is unblackened. When light or heat falls upon these blackened surfaces they are slightly warmed, because of the absorption, and the motion of the rarefied gas resulting therefrom is such that there is a greater pressure on each black side than on the white, and as these pressures all tend to turn the vanes one way they go spinning round when under the influence of heat or light. If the vanes were made of only white material they would still spin round, but not so fast by far as when black surfaces are used, for here there is great absorption of heat.

Other facts about absorbed heat we may learn by keeping our eyes open to all that is passing around us. In a sheet of ice, for example, there is a bit of yellow straw sunk down into it. How came it to sink in that way? Certainly not because of its weight, for there are stones lying about a thousand times heavier than the straw which have not sunk at all. The explanation we come to, after much thought, is that the straw absorbed the sun's radiant heat in the first place, and then gave some of it out again to melt the ice. And this absorbing heat in the first place and then giving it out again is a very common occurrence in Nature, and it is found as a matter of fact that the best absorbers of heat are also the best givers or radiators of heat.

REFLECTION OF RADIANT HEAT.

When radiant heat is reflected it obeys precisely the same laws as light or sound, for the angle of incidence is always equal to the angle of reflection (p. 439). Thus it would appear that there is some reason as well as convenience in having a huge tin fire-screen around a slowly rotating and roasting piece of meat. For if *F* (Fig. 156) represent the place of the fire and *M* that of the meat, it is evident that the meat receives not only the heat radiated from the fire, but also a large quantity which is reflected back on to it by the screen (*S*). And all this heat reflected back to help to roast the meat would otherwise have been wasted in absorption by the walls of the kitchen. Servants, therefore, term such a screen a "hastener" not inaptly, for it hastens the roasting as the "jack" keeps the meat rotating.

If you take one of the reflectors you had made for your experiments in sound (p. 416) you may have personal evidence that it reflects heat. Stand so far from the fire that you are not sensible of its warmth. Now turn the hollow face of one of your tin reflectors towards the fire, and just deflect it a little, so that your face is in the focus. You at once become sensible of the radiant heat reflected from the reflector on to your face.

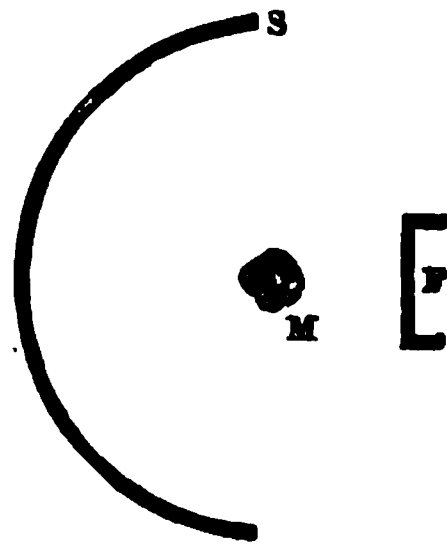


Fig. 156.—ROASTING MEAT.

REFRACTION OF RADIANT HEAT.

You know what a burning-glass is, for, no doubt, you have often experimented with one, and what you did was this: Standing out in the sunshine, you held your double convex lens with one of its faces turned towards the sun, and on the other side you placed a fragment of paper in the focus of the sun's light. The paper soon became charred, from which we may infer that the sun's radiant heat is bent to a focus in passing through the lens as well as his light.

You may even feel the heat in the focus of a flask filled with water, which, you will remember, we said before is a double convex lens. You will, therefore, understand that those very large round bottles which you see in the windows of druggists' shops, filled with coloured water or something of that sort, are sometimes sources of danger; for when the sun is brightly shining on to them his heat rays are brought to a focus, and if there be any combustible material at the focus it will catch fire.

These heat rays pass through all sorts of transparent substances, so that if you procure a small block of ice you can lick it into the shape of a double convex lens, with which you may set things on fire as with an ordinary glass lens.

Fig. 157.—RADIANT HEAT PASSING THROUGH A PRISM.

Dr. Scoresby found these ice lenses very useful in the Arctic regions, for with them he was often able to light fires.

Now, from these facts and experiments it is pretty evident that radiant heat is bent in passing through transparent substances. We require to know now whether it is more bent or less bent than light. To ascertain this, we have to do nothing more nor less than repeat Newton's experiment of admitting a beam of light into a dark room, and placing a prism in the path of the beam. The most convenient substance for the prism in this case is rock-salt. Let *P* then represent our rock-salt prism, placed in the path of a sunbeam (Fig. 157); a spectrum would be produced on a screen conveniently placed to receive it, and upon bringing a thermometer with blackened bulb along this spectrum from the violet end, we should find the mercury to rise more and more as we proceeded towards the red, and beyond the red, in the invisible portion of the spectrum, it would indicate most heat. From which it appears (1) that some portions of the radiant heat coming from the sun are invisible and less bent than light in passing through transparent bodies; and (2) that some portions of the spectrum,

which you may have regarded as light alone, are capable of heating substances that absorb them: thus, *e.g.*, a bundle of red rays falling upon the skin would sensibly warm it, but coming into the eye they create only the sensation of light.

The heat rays falling beyond red light are known as *dark* heat rays.

THE NATURE OF HEAT.

Can we guess now what heat is? We are certainly in a better position to do so than we were at first; and, upon carefully looking at all the facts of the case, we observe how important a part motion takes in the phenomena we have studied, for we can produce heat from the mechanical motion of rubbing, knocking, &c.; and, on the other hand, we can just do the opposite, *viz.*, produce mechanical motion from a fire by means of a boiler and steam-engine. If we suppose, therefore, that heat is a motion of the very minute particles (atoms) of which a substance is composed, then, when we raise the temperature of a thing we make its atoms vibrate, or tremble, more swiftly, and they require, as a matter of course, more room; the visible effect of this being the expansion which we have seen takes place in solids, liquids, and gases when their temperature is raised. To take an example: When you heat the poker you make the atoms of iron vibrate more swiftly and take up more room than they did before, and, consequently, the poker (that is, the whole collection of atoms) takes up more room, or, in other words, grows bigger or expands. But we have seen (p. 427) that violently moving atoms agitate the ether, and so here the ether is agitated, and waves of it are produced, which give one the sensation of heat; and thus the hot poker is a source of that radiant heat we have spoken about. So you might go on explaining heat phenomena, whence it would appear we have made a right guess at last.

ELECTRICITY.

It is safe to say that wherever two dissimilar substances are rubbed together electricity is produced, from which it would appear not improbable that the servant girl who busily dusts all the furniture in a morning may have produced more electricity in her time than the professor whose duty it is to give twenty or thirty lectures a year on the subject. When the soles of your boots are dry you unconsciously produce electricity in walking over the carpeted floor, and if the atmosphere be very dry too the amount of electricity produced may become noticeable, as when Sir Charles Wheatstone found that rising from his seat and walking a yard or two towards the fireplace produced a marked amount of electricity.

Perhaps one of the commonest and most easily made experiments on this subject is the following:—Take a piece of ordinary window-pane glass, dry it well before the fire, and then rub one side of it briskly with a piece of cotton. You will find now that small bits of paper, hair, and other light substances will be attracted towards the glass when held an eighth of an inch or more from them. The operation of rubbing has generated electricity on the glass, so that when it is brought near the bits of unelectrified paper it draws them towards it.

If you borrow an amber-mouthed pipe for an hour or so, and take it and dry it well, you will find that upon rubbing the amber mouthpiece with hot flannel it will draw bits of paper towards it like the glass. This simple experiment with the amber is one of the very few valuable scientific facts bequeathed to us by the ancients. For a long time no use seems to have been

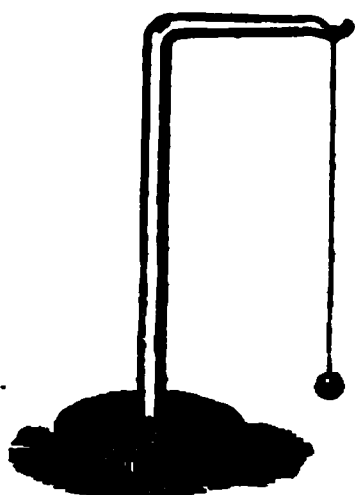
made of it, and it came to the scientific men of the glorious reign of Elizabeth the one "talent" which it had long been. Dr. Gilbert then made judicious use of it, and the "interest" on it has been increasing ever since, giving us of the present day an intellectual fortune in the science of electricity.

You ask, "What is the meaning of the word electricity?" We have to turn to the amber experiment for an answer. It has long been the practice to name new things—inventions, discoveries, and institutions—by means of old words. And in this christening process it has not been to the ancient languages of our own country that we have turned for a word, but to the ancient languages of countries far away—to Greece and Italy. Now, the Greek word for *amber* is *electron*, so that electricity means the excited state of this electron or amber; and as this excited state may be exhibited by a host of different bodies, and may be produced in quite a number of different ways, electricity is the science which takes into account all these substances that may be excited, how it may be done, and all the other methods, where rubbing is not employed, by which we may attain the same end.

DIFFERENT KINDS OF ELECTRICITY.

Being new to this subject, it may be that you have stumbled over one or two expressions used in the preceding paragraphs, such as "electricity of a different kind," &c., and you would naturally ask, "How many kinds of electricity are there?" To which we may as well at once reply: "Only two, and they have been named positive and negative."

These two kinds of electricity are always produced together. When one is rubbing two substances together positive electricity is produced on one of the surfaces and negative on the other; and now we may as well pursue the subject experimentally, so that you can see with your own eyes that it is even as we say.



We want first an electric pendulum, which is very easy to make (Fig. 158). A glass tube is bent at right angles, and fixed in a wooden stand at one end, while the other is turned into a small hook, so that string or anything of that sort may be suspended. Out of a piece of dry pith you may now cut a very small ball; this is for the end or bob of our pendulum. Some raw silk must now be obtained and a thread pulled out of it; attach one end of the thread to the ball and the other to the glass hook by means of gum. When the gum is dry you are in possession of an electric pendulum.

Now, it does not matter what kind of electricity a substance possesses; if it be really electrified any way it will draw the pith ball towards it when you bring them near each other. When the pith ball is drawn towards an excited substance in this way it is attracted just in the same way as the hair, bits of paper, &c., were before (p. 499). Suppose, then, you take a glass rod and a silk pocket-handkerchief and warm them well, you will find upon rubbing the rod briskly with the handkerchief that it will attract the pith ball as usual. Let the pith ball come in contact with the rod; now the ball flies away and cannot be brought near the rod. When the ball came in contact with the rod it received some of its electricity, and then, like badly-agreeing relatives, they kept apart. This is an interesting fact, and to be borne in mind, that when two similarly electrified substances are brought together they repel or shun each other. We will agree to call the electricity generated on the glass when it is rubbed with silk *positive* electricity. And now, suppose you take a stick of

Fig. 158.—THE ELECTRIC PENDULUM.

sealing-wax and a piece of dry flannel. You will find that upon rubbing them together the wax possesses a different kind of electricity from that which was possessed by the glass, for the electrified pith ball is now attracted by the wax, whereas the glass repelled it. The wax, therefore, behaves quite differently towards the pith ball; and we may agree to call the electricity it has after rubbing with flannel *negative* electricity, in contra-distinction to the positive obtained on the glass.

SOME OF THE SUBSTANCES THAT EXCITE ELECTRICITY, AND SOME OF THE WAYS IN WHICH IT MAY BE PRODUCED.

Did you never hear a minute crackling sound when on a fine frosty night you have been stroking pussy? You were producing electricity by rubbing the cat's back; and if you are not afraid, take the cat into a dark room some night and rub its back again. You will probably see some very small sparks, and they are the cause of the sound you hear. These sparks are of extreme interest, for it is probable they differ, not in kind but only in degree, from those magnificent displays of the aurora so very common in Arctic regions, from the lightning flash that we have good reason to fear, and from the electric light which man has utilised for his own purposes. The experiment is of precisely the same nature as the rubbing of glass and cotton together, or of the amber and flannel; and we may add that a cat's fur is often used to excite electricity by rubbing or beating other substances with it, such furs being sold for about half-a-crown each. If you rub smooth glass, paper, wood, or ground glass with such a fur you excite electricity in them, and, like the glass we spoke of in the preceding paragraph, they will then attract light unelectrified bodies, as bits of paper. You may readily try this little experiment. Take a piece of brown paper, and make it hot and dry. Lay it now on a dry table, and brush it smartly with a clothes brush. The rubbing operation excites the paper, and being light, it will cling to the unelectrified wall if you bring it near enough, just as, on the other hand, it would have drawn the wall to it had it been light enough. Electricity produced by rubbing is called *frictional electricity*.

You will perceive that the ways of producing electricity we have so far spoken of are mechanical ones, but it may also be generated by chemical means. If you place some vinegar into a silver thimble, and then dip the point of a needle into the liquid, electricity is produced sufficient to swing the needle of a galvanometer round when wires from the thimble and needle are joined up to it (p. 511). The galvanometer, we may mention by the way, is an instrument which is used for detecting electricity of this kind, and we shall after a while describe it in detail. You might also detect a current of electricity if a penny and a florin were separated by a circular piece of blotting-paper wet with being soaked in a solution of common salt. Here, as before, two wires, one leading from the copper and the other from the silver, would have to be joined up to the galvanometer in order to detect the electricity. Electricity of this kind is called *voltaic electricity*, and may be either positive or negative, like frictional electricity.

Electricity is also very largely produced in Nature's operations. The clouds are charged with it, and when they happen to come near to some other body which has electricity in it of a different kind, as, *e.g.*, a tall chimney, the steeple of a church, or a towering tree, a huge spark, which we call lightning, may pass between them, and the chimney or steeple may be hurled down or the tree riven asunder. Electricity is produced in our own bodies, each of the white cords in our systems which we call nerves having the power, when experimented with, of turning the galvanometer needle. In some animals we may even have manifestations of the electricity produced in their bodies without having recourse to cutting

them up. It is so in the case of a flat-fish called the torpedo (Fig. 159), also in another called the electric eel. Both fishes may now often be seen in the tanks of our public aquaria, and you have doubtless often seen the big eel, with its belly-fin wriggling like a long blanket in the wind when its top has been fastened on hooks to dry before being sent into the market.

GUTHRIE'S ELECTRICAL TOUCHSTONE.

When frictional electricity is generated we detect it by means of the gold-leaf electroscope and several other instruments. It is possible, however, in some cases to detect the electricity produced by an exceedingly simple and pleasing device,

Fig. 159.—THE TORPEDO FISH.

which we owe to Professor Guthrie. Finely powder part of a stick of red sealing-wax and also some brimstone. Mix the dry powders until the mixture is of a yellowish-pink, and then place some of it in a muslin bag and tie up. Upon shaking the bag a shower of sulphur and wax is produced.

Now suppose you have a sheet of vulcanised indiarubber before you; you take pieces of metal, and draw lines or anything else on the sheet of indiarubber, and then scatter a shower of the mixture on to it. The metal tracks appear very different, for while some are red because of the wax they have attracted, others will be yellow, having drawn the sulphur to them in preference to the wax. Tin, nickel, silver, antimony, bismuth, platinum, copper, and gold tracks appear yellow after sprinkling the mixture, and zinc, iron, cadmium, mercury, and magnesium will give red tracks. It will thus be seen that this sheet of indiarubber is not unlike the piece of slate called the touchstone, sometimes used by jewellers when testing the purity of gold and silver, whence the name of *electrical touchstone* that Guthrie has given it. The experiment may be made as we have described, but perhaps better still by nailing the vulcanised indiarubber to a board, and having between it and the board a sheet of tin-foil of the same size. Other mixtures may be employed for dusting as well as that of wax and sulphur, and perhaps one of the best of these is a mixture of dry red lead and sulphur.

The experiment appears of rather a magical nature, for before sprinkling the powder no person who had not seen you stroke the sheet of indiarubber could tell one group of metals from another; for if you were to take three metals of the first group we have given—say tin, nickel, and silver—and make the letters

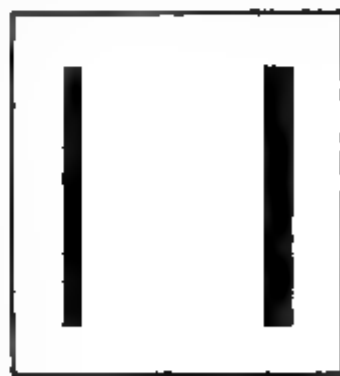


Fig. 160.—GUTHRIE'S ELECTRICAL TOUCHSTONE.

T, N, and S respectively with them, and then, after that, if you were to take three of the second group we have mentioned—say zinc, iron, and cadmium—and in like manner were to put down the three first letters of their names (Fig. 160), some one just coming in after this operation would hardly be able to see the tracks of these metals on the indiarubber lying on the table, but immediately you dusted it with the mixture of wax and sulphur from your muslin bag, the letters T, N, S would stand out of a sulphur yellow, and the letters Z, I, C would come out equally prominently of a bright red.

The following are directions for making the electroscope we spoke of at the commencement of this paragraph:—

HOW TO MAKE AN ELECTROSCOPE.

Take a flask, and clean and dry it well; choose a cork that will fit neatly into it, and through the cork bore a hole to hold a piece of glass tubing about one inch long. A disc of

zinc must now be cut, say an inch and a half in diameter, and through it two holes must be drilled, one near the edge and the other at the centre. To the central hole one end of a piece of brass wire, nine inches long, has to be soldered, the other end being turned at right angles to the remainder of the wire. Warm the tube in the cork and fill with shellac, and then pass the wire through it before bending the end at right angles as just directed. After fixing the glass tube in the cork, shellac the outside of the glass well. Cut two strips of Dutch metal, three inches long and half an inch broad, and attach these to the hook of the brass wire after cleaning it well. You simply smear the sides of the hook with gum, and then lay on them the ends of the strips of Dutch metal. The wire, with its pendent strips of metal, is now carefully placed in the flask, and the cork pressed tight. The instrument, when finished, presents the appearance given in

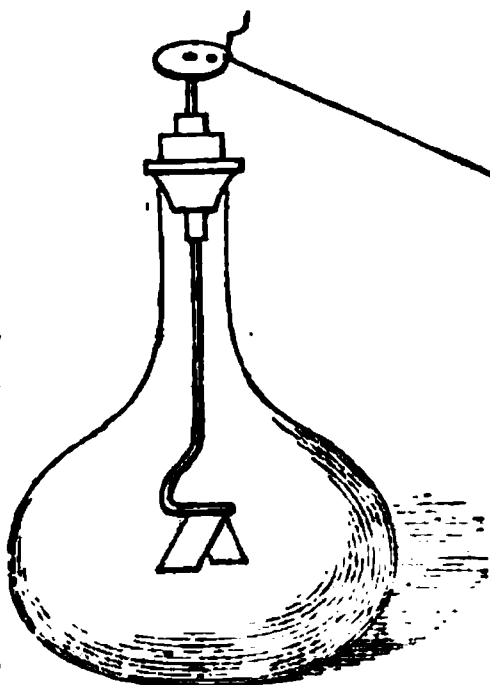


Fig. 161.—ELECTROSCOPE.

Fig. 162.—ACTION OF STRIPS IN THE ELECTROSCOPE.

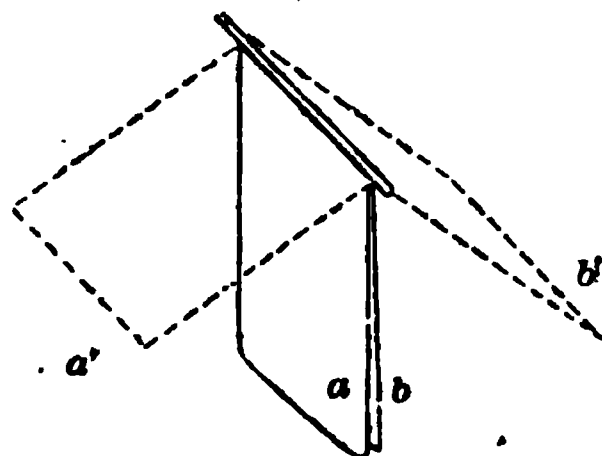


Fig. 162.—ACTION OF STRIPS IN THE ELECTROSCOPE.

If any electrified body be now brought into contact with the disc of metal, the pendent strips at the bottom (*a b*), being similarly electrified, fly apart, and take the positions *a' b'* (Fig. 162), and if the instrument be in good working order they will remain apart for a while, making it easy to do the experiments we will now describe.

EXPERIMENTS WITH THE ELECTROSCOPE.

With the electroscope one can readily ascertain the kind of electricity which is produced in any experiment. First rub a piece of wax with hot flannel, and then touch the plate with the wax; the leaves will diverge with negative electricity. Upon now bringing the electrified substance to be tested near enough to the metal disc of the electroscope, the leaves will either collapse or fly farther apart; in the latter case the substance is charged with negative electricity, and in the former it is probable that the substance is charged with positive. Since, however, a neutral body—i.e., one charged with neither positive nor negative electricity—will make the leaves collapse, the only thing you can depend upon is farther divergence of the leaves. You therefore rub a rod of glass with silk, and bring the rod in contact with the disc of the electroscope. The leaves diverge with positive electricity, and if the substance whose kind of electricity we are desirous of knowing now causes farther divergence of the leaves when it is brought near the disc, then we are sure that it possesses positive electricity.

You may now repeat a great number of experiments with various substances, ascertaining in each case the kind of electricity which is produced, and entering your results into a note-book.

You may also ascertain with the electroscope that some substances conduct electricity readily, while others do not. Thus, if one end of a piece of wire be fastened in the hole of the metal disc (Fig. 161), and the other be wound round a glass rod, the electricity developed on the rod by friction travels quickly along the wire and diverges the leaves. If it had been a string of indiarubber no such divergence would have been observed. Substances may thus be divided into conductors and non-conductors; and glass is one of the most common of the latter, hence its use for supporting the electrified parts of an electrical machine, as it will not allow the electricity to escape. You can readily see, then, that electricity in a body which is supported on non-conducting stems is imprisoned; like Napoleon at St. Helena, it is *islanded* off, and cannot escape, or, to use the proper word, it is *insulated* (Latin, *insula*, an island). Non-conducting substances are therefore spoken of as *insulators*.

ACKROYD'S EXPERIMENT.

We have so far only produced electricity by rubbing one solid against another; electricity may, however, be generated by the friction of a liquid against a solid. The following simple experiment, which

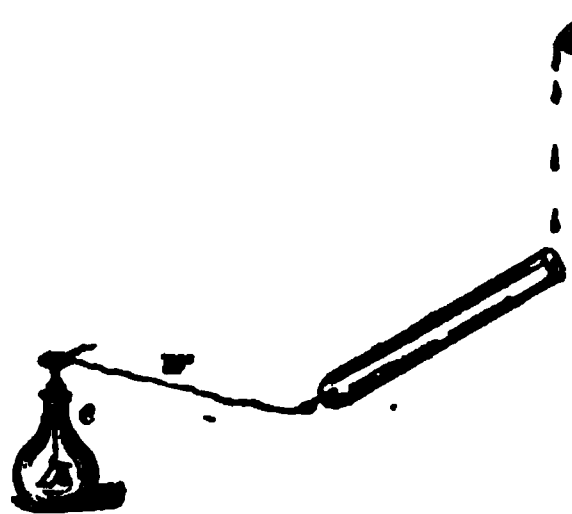


Fig. 163.—ELECTRICITY PRODUCED BY THE FRICTION OF A LIQUID.

is easily tried, illustrates this (Fig. 163). Take a piece of glass tubing about half a foot long and three-quarters of an inch bore, and seal up at one end, inserting during the operation a piece of platinum wire, so that it has a free portion inside and enough to form a loop on the outside. Connect the tube now to an electroscope (*e*) by means of copper wire (*w*). If you now warm some mercury in a crucible (*c*), and then pour it down the tube in drops, the friction of the liquid mercury against the sides of the tube will generate electricity, and immediately the drop of electrified mercury reaches the bottom of the tube and comes in contact with the platinum wire, the electricity is conducted along the wire (*w*), and the leaves of the electroscope fly asunder. All your apparatus must be dry. You will perceive that we have here also a good example of the conducting property of the wire (*w*).

FRICTIONAL ELECTRICAL MACHINE.

We have produced electricity by rubbing glass, and the same operation is performed with much greater ease by means of a machine where the glass is made to revolve by turning a handle whilst some soft body is pressed against it. An arrangement of this kind, known as the Cylindrical Machine, is represented in Fig. 164, where a cylinder of glass is pressed by a cushion at C, and to the upper portion of the cushion a sheet of silk is attached, which is kept on the cylinder by its rotating motion. The flap of silk is not shown in the diagram, but its position will be seen from the section, Fig. 165. The oblong rubber (C) is covered with leather on the face presented to the cylinder. Opposite the rubber, and on the other side of the glass, there is a hollow tinued-iron cylinder (B), with spikes projecting from it, or it may be made of wood and coated with tin-foil by means of gum. This cylinder (B), three or four inches in diameter, is termed the *prime conductor*. Both rubber and prime conductor stand on glass legs. If you make a machine of this kind you have to buy the glass cylinder, and in fixing wires into the prime conductor the greatest care must be taken to leave no sharp edges anywhere, save those of the projecting spikes. Before using, the machine has to be made dry and warm, the cylinder has to be clean, and the rubber has

Fig. 164.—CYLINDER ELECTRICAL MACHINE.

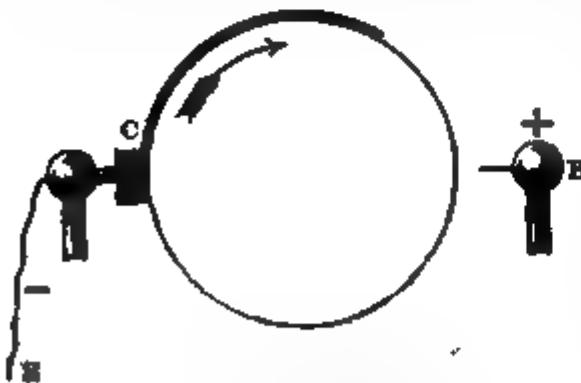


Fig. 165.—CROSS SECTION OF CYLINDER MACHINE.

to be furnished with an amalgam. To make the amalgam, two parts of zinc and one of tin are melted together, and added to six parts of mercury previously heated in a crucible. The mixture, after being stirred until cold, is then reduced to a powder and made into a paste with lard. The mixture is spread over the cushion of the rubber, or a layer of lard may be laid on the cushion, and then the powdered amalgam well sprinkled on to it. It is perhaps necessary to add that the operation of making the amalgam ought to be conducted under a chimney, as the

mercury fumes which might be produced are injurious. A chain extending from the rubber is now attached to the gas-pipe, the prime conductor's row of teeth is brought within an eighth of an inch off the cylinder, and then the handle

of the machine is turned round. If you hold your hand near the cylinder after a few turns, it will feel as if being pricked with pins, and in the dark you will see sparks proceeding from one to the other.

If you desire to try your hand at making a very cheap machine, you may proceed as follows. Break off the end of a wine-bottle by nicking it with a file, and then drawing a red-hot iron over the nick and carrying the crack produced all round. Fill up the end now with a piece of wood, through the centre of which a piece of thin metal rod is passed to act as one end of an axle, while in the neck a handle is fixed. The prime conductor is now made of wood, and covered with tin-foil. The cushion of the rubber may be stuffed with horsehair or well-dried wool. Both rubber and cushion must be supported on glass rods, and the row of metal points projecting from the prime conductor may be pins or short bits of wire. In fixing the glass portions of the apparatus electrical cement must be used, which consists of one part by weight of beeswax, one of red ochre, five of resin, and about one-eighth of a part by weight of plaster of Paris. To support the ends of the bottle-cylinder uprights of deal

may be used, fixed on a stand of the same material.



Fig. 166. BLOWING OUT A CANDLE WITH AN ELECTRICAL WIND.

EXPERIMENTS WITH THE MACHINE.

Insert a piece of metal in the prime conductor, bent as at *a*, and sharply pointed at the end. Upon generating electricity a wind seems



Fig. 167. — THE ELECTRICAL WIND AT WORK AGAIN.

to blow from this point, and if you hold a candle near it you may succeed in blowing it out (Fig. 166).

The same experiment in another form consists in having a wire inserted in the prime conductor with a nicely-balanced wheel at the top, which, instead of a rim, has points projecting from each spoke, and all turning in the same direction in its circumference. This wheel will spin rapidly round when electricity is produced by the machine (Fig. 167).

Place a doll's head with flowing hair on to the end of the rod stuck into the prime conductor. Immediately it becomes charged with electricity its hair stands on end as if it had received a terrible fright (Fig. 168).

CONDENSERS.

For many experiments where the machine is employed what are called *condensers* are used, i.e., instruments for storing up electricity. A very simple one, known as *Franklin's Plate*, may readily be made. A plate of glass is coated on each side with tin-foil to within about a couple of inches from the edges (Fig. 169). You have thus two good conductors, separated by an insulator, the glass. The glass is fixed in a wooden frame. Now, when a wire is brought from the prime conductor of the machine to the upper sheet of tin-foil, the latter becomes charged with

Fig. 168.—AN ELECTRICAL FRIGHT.

more electricity in the presence of the tin-foil on the other side than it otherwise would have been. A small ribbon of tin-foil extends from the under coating to a ring at the edge of the frame, and a metal chain must extend from this ring to the earth.

A COIN THAT MUST NOT BE HANDLED.

Now place a shilling on the Franklin's plate, while it is connected with the machine by means of the wire, as we have just described, and with the earth by means of the chain. After making several turns of the cylinder, request *sc* to take up the shilling; in so doing they r shock, which makes them jump (Fig. 169).

HOW TO MAKE A LEYDEN JAR AND U

Having procured a glass jar of form ; Fig. 170, both inside and outside are coat tin-foil up to within a couple of inches fi top. A metallic knob is fixed at the en thick wire terminating in feet at the bot that it will stand as represented.

To charge the jar with electricity, you grasp the outer coating with the hand, as the metallic knob in contact with the prir ductor while the machine is being turned. ¹⁷⁰ not allow the machine to be turned too long, or the overcharged jar will discharge itself.

Fig. 169.—THE UNTOUCHABLE COIN.

To discharge it—if you want a shock—you touch the knob with one hand while you are grasping the outer coating with the other. To discharge the jar without inconvenience, a “discharger” is required, which may easily be made. Roll a piece of gutta-percha into the form of a handle, and while one end is hot and soft pass a wire through it. Bend the wire into a curve, so that when one end is brought into contact with the knob of the jar the other may touch the outer coating of tin-foil. Solder brass knobs to each end. In discharging a charged jar, one of the knobs of the discharger is placed on the outer coating of tin-foil, and the other is then brought near to the ball of the jar (Fig. 171). A spark passes and a loud noise is heard.

Fig. 170.—LEYDEN JAR WITH MOUTH OPEN.



Fig. 171.—DISCHARGING A LEYDEN JAR.

TO GIVE A SHOCK TO SEVERAL PEOPLE.

Suppose there are four persons (A, B, C, and D) who are desirous of receiving the shock. A wire is wound round the outer coating of the Leyden jar; the jar is then charged and placed on the table. The four persons join hands, and while A holds the end of the wire leading from the outer coating of the jar, D has also hold of a wire which is in communication with one of the knobs of a discharger. You now seize the insulating handle of the discharger and bring one knob only in contact with the knob of the Leyden jar. A shock will be experienced by the four persons, and unless A be cautioned he may, by his sudden antics, pull the jar off the table.

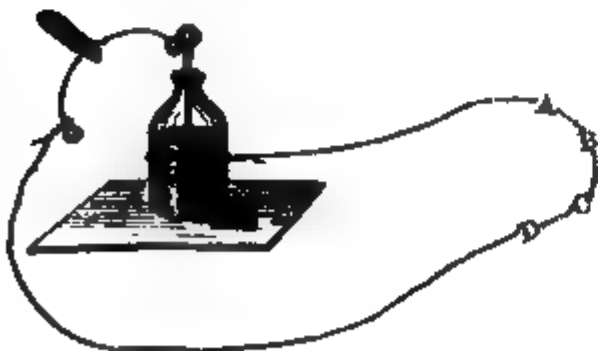


Fig. 172.—GIVING A SHOCK TO PEOPLE.

VOLTAIC ELECTRICITY.

We have already referred to voltaic electricity, and to arrangements by means of which it may be produced. You would produce it if you immersed a sheet of zinc and a sheet of platinum in acidulated water contained in a cup (Fig. 173).

ZINC

PLATINUM

Such a simple arrangement is called a *cell*; and upon joining the metals together with a wire, a current of electricity flows through the wire from the platinum to the zinc, and thence through the liquid to the platinum again. We shall now describe how to make a very useful cell for the generation of voltaic electricity, and one which we shall often have to use.

TO MAKE A DANIELL CELL (Fig. 174).

Fig. 173.—SIMPLE CELL.

Procure an empty jam-pot, say about four inches deep, and buy a porous cell, which will cost a few pence, at some chemical ware shop. These cells are made specially for the purpose we are going to describe, and are unglazed. We want now a sheet of plate copper, say two inches by six, and a sheet of zinc, say about six inches by four and a half inches. Bend the copper in its short direction, so that it may be placed upright within the porous cell, and bend round the zinc in its long direction, so that it may also stand upright within the jam-pot. Solder a long copper wire to the upper end of each of these metal plates; or, what is better still, solder to the top of each a brass binding screw, so that the copper wires may be screwed into contact with each plate. We now require some oil of vitriol and some sulphate of copper. Take the oil of vitriol you procure at the druggist's and dilute with eight times its volume of water, and then pour a quantity of this diluted vitriol into the jam-pot. Dissolve a few of the crystals of sulphate of copper in water, and pour the solution into the porous cell, adding a few crystals of the sulphate besides. Now place the cell into the pot containing the oil of vitriol, and the plate of copper in the solution of sulphate of copper; finally put the zinc plate, after it is amalgamated, into the dilute oil of vitriol, and join the copper wires to the screws at the end of each plate. The Daniell cell is now ready for any of the uses which we shall hereafter describe.

To amalgamate the zinc plate, pour a little of the dilute oil of vitriol into a saucer, and also a few globules of mercury. Now dip the zinc into it, and rub the mercury over its surface with a cork. The mercury will adhere to the surface of the zinc, and must be spread all over its lower surface, where it will, in future, have to dip in sulphuric acid in the Daniell cell.

HOW TO SILVER A BRASS CHAIN.

You may now try your hand at electro-plating, an art which has become of very great importance. If you happen to have a brass chain you may proceed to give it a respectable coating of silver in the following way:—Get some nitrate of silver and some cyanide of potassium, and dissolve them in separate quantities of water. Now add the cyanide to the nitrate of silver: a precipitate is formed. Add more cyanide of potassium: the precipitate begins to dissolve;

Fig. 174.—DANIELL CELL.

and we might go on adding the solution of cyanide of potassium until no more precipitate was left. Stop adding the cyanide just before this point is reached, and when the precipitate left has sunk to the bottom pour the clear fluid into a basin. Take the Daniell cell now, and attach a bit of platinum wire to each of the ends of the copper wires leading from it. The end of the wire from the copper must be attached to a shilling piece, that has now to be sunk into the basin of clear liquid (Fig. 175). The platinum end of the other wire from the zinc must be attached to the chain, and this likewise has to be dropped into the basin. A coating of silver is now slowly deposited on the chain, and when the experimenter thinks the coat is thick enough it may be withdrawn, dried, and polished with a brush and whitening.

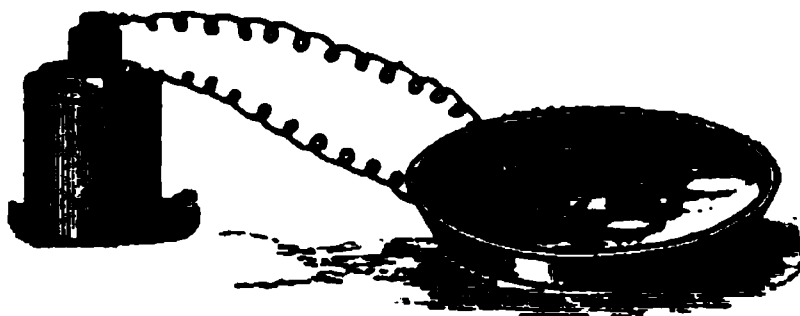


Fig. 175.—SILVERING BRASS.

A word of caution: the chemicals here employed are poisonous, and must be kept out of the way of the children.

TO TAKE A COPY IN COPPER OF A MEDAL OR COIN.

This is an interesting example of electrotyping. Suppose you want to copy a rare coin in copper, your first step is to get a good mould of it by impressing it on sealing-wax or gutta-percha. While the impression, say in gutta-percha, is still soft you stick a copper wire through the side of it, taking care not to let the wire come in contact with the bottom of the impression, which would be spoiled. Blacklead is now spread all over the inside of the cavity, and brushed on by means of a camel-hair painting-brush or soft tooth-brush. The wire is now attached to the one leading from the zinc of the Daniell cell. A strong solution of sulphate of copper is poured into a saucer with a drop or two of sulphuric acid. And now a piece of copper is attached to the wire from the copper end of the Daniell cell, and both the piece of copper and the blackleaded mould are immersed in the solution of sulphate of copper and left for a couple of days. The copper deposited over the blacklead will then be thick enough to remove by means of the blade of your penknife. The under side of the copper impression will be a faithful copy in copper of the coin you at first impressed into the gutta-percha.

These are some of the uses to which a current of voltaic electricity may be put. We must now turn to consider the instrument by means of which we detect voltaic electricity, just as before we detected frictional by means of the electroscope, and this instrument is the galvanometer: In its construction a very remarkable fact is taken advantage of, viz., that if a current of electricity be proceeding in a certain direction, with a magnet just below or above it, and also pointing the same way, this current will swing the magnet round, and if it be strong enough, make the magnet take up a position at right angles to the direction the current is flowing in.

HOW TO MAKE A GALVANOMETER.

Procure about twenty feet of No. 24 covered copper wire, and wind it round an oblong piece of wood so that you have a coil about two inches long and half an inch broad. Dip the coil in melted paraffin, fix it on a circular board, and carry the two ends of the wire through holes *a* and *b* to the back of

the board, and thence in grooves to the ends of binding screws *c* and *d*, to which they must be soldered (Figs. 176, 177).

A stout brass wire must now be thrust through a cork (*e*), and then be bent round into an arch (*f e g*) and its two ends fastened

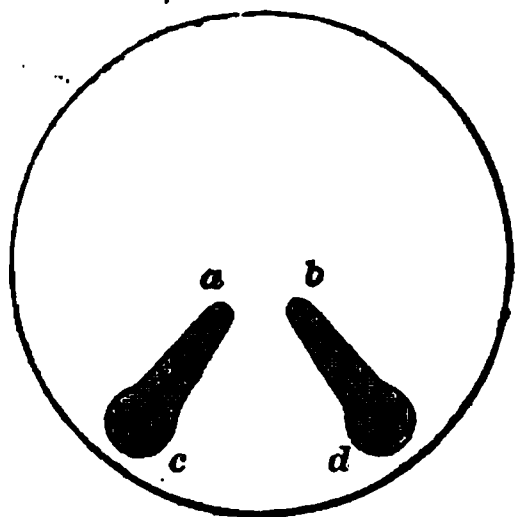


Fig. 176. — UNDER SURFACE OF GALVANOMETER.

Two needles are now magnetised and fixed half an inch apart by means of twisted fine copper wire, with unlike poles adjoining each other, as in Fig. 178. By means of a single silk fibre the needles are suspended, as in Fig. 177, from the cork, the lower needle being passed through the middle of the coil, so that it can freely

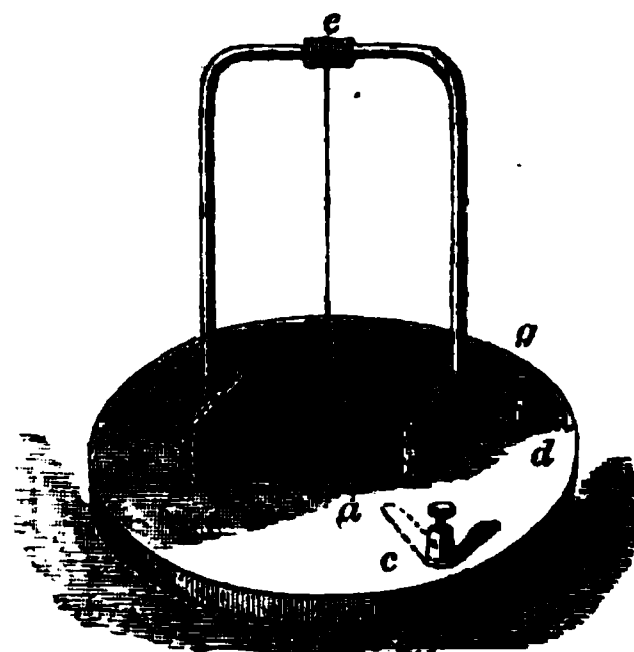


Fig. 177. — MAKING A GALVANOMETER.

move in the middle of it, while the upper needle moves above it. Some difficulty may be experienced in dealing with a single fibre of silk, therefore attach one of its ends to the cork by means of a minute touch of gum,

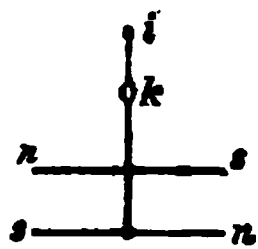


Fig. 178. — GALVANOMETER NEEDLES.

and then wind some of it on the cork, leaving sufficient of it to reach down to the coil of wire. Next tip the end (*i*) of the copper with gum, and no difficulty to speak of will be experienced in catching the end of the fibre with it, when the wire with its captive fibre must be allowed to stand until the gum is dry and hard. A piece of cardboard is now cut into a circle and graduated to degrees (Fig. 179). A hole is made at the centre sufficiently large for the needles to be passed through, and now the circle of card is placed on wooden supports, which have been glued to the board at *f'* and *g'*. A fibre of glass may now be drawn out from a piece of tubing at the blow-pipe flame, broken off when cold, and passed through *k*, when the needles are adjusted with the card over them. This fibre of glass will act as an index, being above the level of the cardboard circle. But before fixing the glass in the copper wire, care must be taken to have the needles of such strength with respect to each other that they will stand in any position when suspended by means of the silk fibre, the particular arrangement of them in Fig. 178, being for this purpose. The needles are adjusted to proper height by turning round the cork (*e*) and winding on or dealing out the fibre as may be required. You finally place a glass shade over the arch and coil, so as to keep air currents from the needles (Fig. 181).

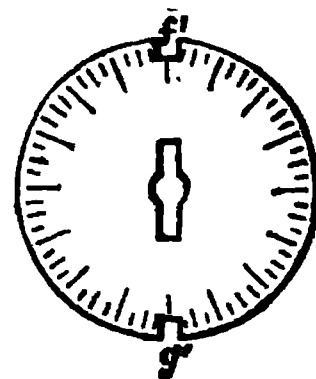


Fig. 179. — SCALE OF GALVANOMETER.

Now when your galvanometer is fitted up try the experiments we have before alluded to (p. 501), by filling a silver thimble with vinegar and putting a needle into it, taking care that the needle does not come in contact with the sides; and by having a florin and a penny separated by paper wet with brine. In each case wires from the metals must be joined up to the galvanometer (Fig. 180).

THERMO-ELECTRICITY.

Solder copper wires to strips of copper and iron. Join up the free ends of the wires to the galvanometer, as in Fig. 181, and grasp the strips of metal, one lying over the other, between the finger and thumb. The warmth of the hand soon generates a current of electricity, which is made apparent by the galvanometer needle turn.

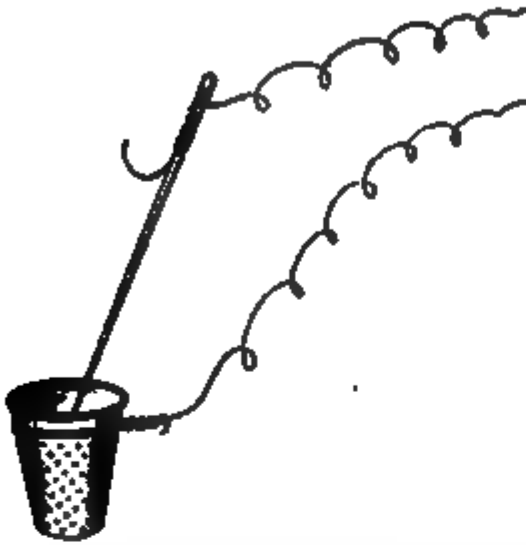


Fig. 180.—THERMUPLE AND NEEDLE SOURCE OF ELECTRICITY.

Fig. 181.—THERMO-ELECTRIC EXPERIMENT.

ing through several degrees. The current of electricity now produced is called a thermo-electric current. You may experiment in the same way with all the metals you can lay hold of, and you will find that when a couple of them are heated as we have described a current is produced, which makes the galvanometer needle move. Two strips of metal used in this way are called a thermo electric-couple.

INDUCTION.

One of the strangest things perhaps in the whole range of electrical science is this: that a current of electricity flowing through one wire (*a b*) generates a current in another wire (*c d*), with which it is in no visible way connected. (Fig. 182). Certain it is, however, that every time the flow of electricity is stopped in *a b*, and every time it is started, the galvanometer at *g* exhibits signs of disturbance. This phenomenon is termed *induction*, and an exceedingly useful instrument, known as



Fig. 182.—ELECTRICITY PRODUCED IN A WIRE IN NO WAY CONNECTED WITH THE BATTERY.

the *Rhumkorff's Induction Coil*, is made to exhibit some of the more surprising effects due to induction. We cannot, however, do more than describe how the instrument is made.

HOW TO MAKE AN INDUCTION COIL.

Fig. 183.—SECTION OF INDUCTION COIL.

the two ends, so as to make a sort of bobbin (Fig. 183). Wind two layers of No. 22

Make a cardboard tube about three inches long, and glue rings of wood (*w w'*) to

covered wire evenly around the cardboard, and bring the ends through the ring of wood (w'). This coil of wire is called the *primary coil*, and the end e goes to the contact breaker, and from there to one of the poles of the battery, and the end (e^2) goes to the other end of the battery. Paint the primary coil well over now with shellac varnish or melted paraffin, and when dry wind round it two or three turns of paraffined paper (2, Fig. 183). About four ounces of No. 30 wire (4) is now fixed within the bobbin.



Fig. 183.—
PLAN OF
CONTACT
BREAKER.

The coil is next (Fig. 184) fixed on a shallow box (B B), a couple of binding screws (b^3 b^4) are placed in front of it, and one end of the primary wire is conducted to b^3 . Two uprights of brass are fixed at one end, their position being determined to a great extent by the position of the end of the bundle of wires; u^2 has a slit in the top of it, into which one end of a piece of steel spring is passed and fastened by means of the screw. At the other end of the spring, and on the side turned towards the bundle of wires, a button of iron (i) is riveted, and a bit of platinum is also riveted at s (Fig. 185). A screw passes through the summit of u^1 , and a bit of platinum is soldered into a hole bored into the tip of the screw. The brass upright (u^2) has to be so placed that the button (i) can knock against the ends of the iron wires; and u^1 must be so fixed that the platinum tip at the end of its screw can be pressed against the bit of platinum riveted to the spring. The remaining wire of the primary is connected to u^1 , and u^2 and b^4 are likewise connected by a wire; u^1 and u^2 are connected with the condenser, which we shall next describe.

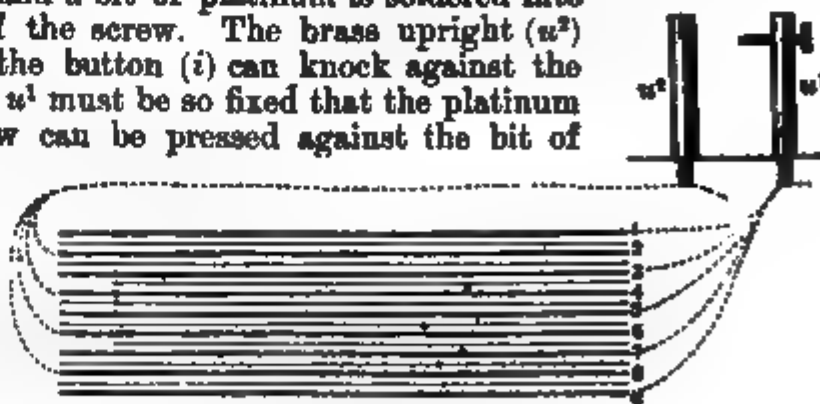


Fig. 186.—THE CONDENSER.

Sheets of paper are painted with a solution of shellac in methylated spirit, and when dry they are cut of the size of the inside of the box upon which the coil

rests. These sheets of paper are alternated with sheets of tin-foil, and the latter are joined up to the supports (u^1 and u^2) of the contact breaker in a fashion which will be understood from Fig. 186, where the sheets of tin-foil numbered 1, 3, 5, 7, 9 are joined up to u^1 , and the sheets numbered 2, 4, 6, 8 up to u^2 . These sheets of foil and shellacked paper are pressed tightly into the box under the coil, and kept there by a back of thin wood. Wires from the battery are now joined up to b^3 and b^4 , and upon leading wires from b^1 and b^2 , and grasping them in the hands (and for this purpose brass handles are usually employed), shocks will be felt.

MAGNETISM.

SIMPLE MAGNETS, AND EXPERIMENTS WITH THEM.

To commence experimental operations, a horseshoe magnet may be obtained for a few pence at any toy-shop. Draw one of the limbs of this magnet over a sewing-needle several times, and always in the same direction. Now, upon sticking this needle into a piece of paper, and suspending it by a long thread from some convenient support, as in Fig. 187, it will be observed that the needle takes up a position such that one end points to where the sun is at noon, and the other end, of course, in just the opposite direction. The former end of the needle is called the south pole, and the latter the north. So that there may be no mistake, put an N and an S at the ends of the paper corresponding to these poles. You are now in possession of a very simple magnet, with its poles pointing north and south; and as it will have taken you no more time to make it than it has taken us to tell you how, you may as well make another just in the same way, marking N and S on the paper again, so that there may be no mistake as to the individuality of the poles (Fig. 187).

We have now two sewing-needle magnets, and upon bringing their like ends together, i.e., the ends marked N or the ends marked S, they shun each other, from which fact we are justified in saying that *like poles repel each other*. But suppose now we present unlike poles to each other, i.e., N to S, or, what amounts to the same thing, S to N, will they still repel each other? Upon trying the experiment you will find this not to be the case, for upon bringing unlike poles near each other they display, as it were, the greatest desire to come together, from which we derive another important lesson that *unlike poles attract each other*. Hence, if you have a magnet, and do not know which is its north pole or which its south, you have nothing to do but bring it near one of these suspended needles, when its behaviour towards it will soon show which is its north and which its south pole.

Put a very light sewing-needle on to a sheet of white paper resting on the table, bring now one of the ends of the horseshoe magnet towards the needle: the needle will be attracted and slide towards the magnet. If now the needle be

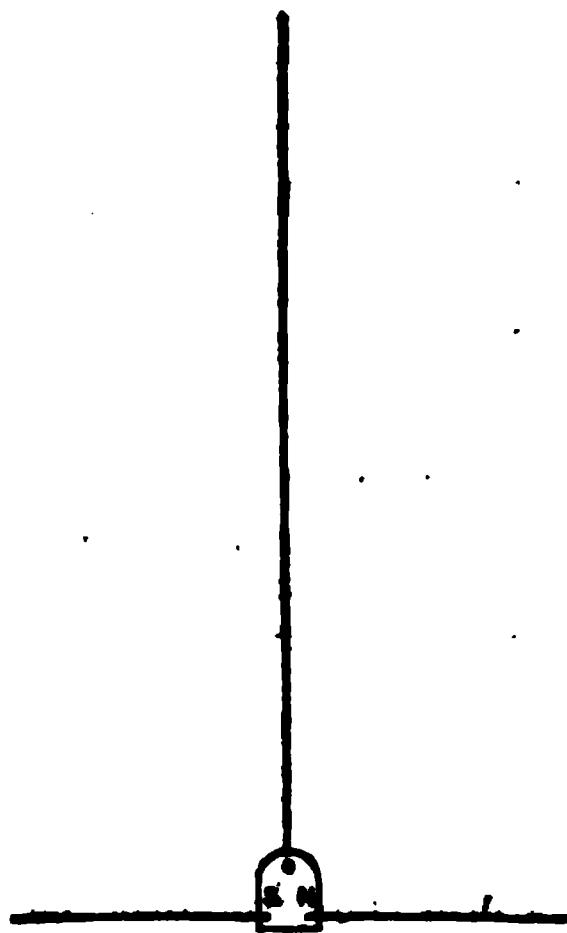


Fig. 187.—SIMPLE MAGNETIC NEEDLE.

stroked with one of the poles of the magnet, and if it is stroked say a dozen times in the same direction always, it will now differ in its behaviour, for while

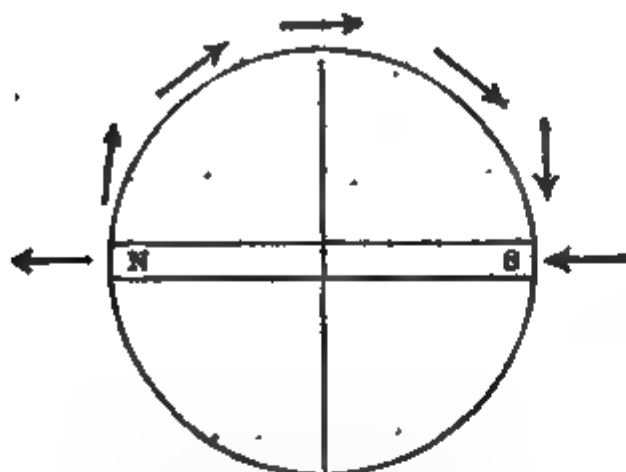


FIG. 188.—EFFECT OF BAR MAGNET ON A MAGNETISING NEEDLE.

one end of the needle will be attracted when one of the limbs of the horseshoe is brought near it, the other end of the needle will be repelled by the same limb of the horseshoe. What has happened? The sewing-needle has been converted into a magnetic needle by the stroking.

TO MAKE A BAR MAGNET.

Procure a strip of steel a few inches long. Make the ends square by filing, and now draw one end of your horseshoe magnet along its whole length. Repeat this operation a great many times, taking care to always use the

EFFECT OF THE BAR MAGNET ON A MAGNETISED NEEDLE.

If you now lay your bar magnet on the table, and suspend over it one of your magnetised needles just over the middle, the needle will be parallel to the bar. And if the arrow-head represent the north pole of our needle, it will take up the positions represented in Fig. 188 as we take it over the bar from one pole to the other.

AN EXPERIMENT WITH IRON FILINGS.

As the bar magnet lies on the table, cover it with a sheet of writing-paper, keeping the paper perfectly flat by means of packing on each side of the magnet, or what is better, perhaps, use stiff cardboard. Sprinkle iron filings over the paper or cardboard. The filings dispose themselves as in Fig. 189. You will observe that on each side of the bar magnet each particle disposes itself, like the magnetised needle we have just been experimenting with. The iron filings, therefore, arrange themselves in curves, and these are generally spoken of as *lines of magnetic force*.

FIG. 189.—LINES OF MAGNETIC FORCE.

HOW TO COPY THE LINES OF MAGNETIC FORCE.

Make a solution of ground gall-nuts, and brush over a sheet of paper with the solution, removing superfluous moisture with blotting-paper. Place the damp

paper over the curves, and press it evenly on them. Carefully lift the paper, dry quickly, and shake the adhering filings off. A picture of the curves is left on the paper.

THE MARINER'S COMPASS.

For steering his ship on the pathless ocean, the mariner wants some means of telling which is north, south, east, or west; and he employs the magnetic needle for this purpose. It is hardly worth while describing it, as every boy must have seen a compass, and you may, indeed, buy a small one from any optician for a few pence (Fig. 190). This constancy, however, of the needle in pointing north and south makes one ask—"What is it which makes the compass needle take up nearly always the same position with respect to north and south?"

THE EARTH IS A MAGNET.

It is generally supposed, in answer to the preceding question,

Fig. 190.—THE MARINER'S COMPASS.

that the earth is an immense magnet, and if you regard Fig. 188 as a section of the globe we live on, with magnetic poles north and south, one can see that the needle would be kept pointing to these poles: in other words, would be always in the curve joining one magnetic pole to the other. There is another peculiarity also which we should look for, and this is indicated in our study of the behaviour of a magnetised needle when near a bar magnet. Just over either of the poles the needle was perpendicular to the

surface of the bar; so, likewise, a magnetic needle, if free to move in a vertical plane, ought to take quite a vertical position over the earth's magnetic poles. A pole of this sort has been found in the northern hemisphere, and likewise one in the southern, where a magnetised needle of this sort, called a "dipping" needle, takes a vertical position. Neither of these magnetic poles coincides with the poles of the earth's axis.

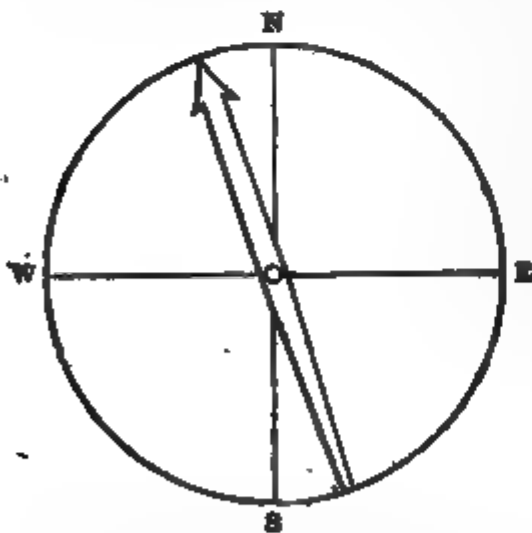


Fig. 191.—DECLINATION.

THE COMPASS NEEDLE DOES NOT POINT TO THE TRUE NORTH.

Never since the years 1657 to 1662 has the needle pointed in a true northerly direction, and it alters its position slightly every year. In 1850, for example, the needle pointed about $22\frac{1}{2}^{\circ}$ west of true north, and fifteen years later it was $21^{\circ} 6'$ west of north. Hence, where observations of the bearings of places have to be made for surveying and such-like purposes, one has to learn from the recognised authorities what is the amount of deviation from the true north, or the *declination* (Fig. 191), as it is termed, for the current year.

HOW TO MAKE A TOM THUMB ELECTRO-MAGNET.

Take a piece of iron wire about two inches long, and bend it into a horseshoe shape. Closely wrap round this from one end to the other silk-covered wire (Fig. 192). Upon connecting the ends of the wire to the terminals of the Daniell cell, the ends of the wire will draw to them a sewing-needle, thus showing that the iron wire has been magnetised by the electric current flowing round it. It would appear, then, that the iron wire has been converted into a magnet by the electricity, because it would not attract a needle at all before the current was passed through the silk-covered wire. It will now be highly interesting to see whether the ends of the iron wire possess the peculiarity of repelling one end of a magnetic sewing-needle and attracting the other. With this end in view, bring one of your sewing-needle magnets carefully near to one of the ends of this iron wire while the current is flowing through. One end of the needle is

Fig. 192.—SMALL ELECTRO-MAGNET.

very evidently shunned, while the other is drawn towards the wire. It is now pretty obvious that we can tell what are the names of the poles of our Tom Thumb electro-magnet, because we have learnt that like poles repel each other, while unlike poles attract each other; hence, that end of the iron wire which repels the north end of our needle is the wire's north pole, and the remaining pole is its south one, and it will repel the south pole of our needle. Let the poles of the Tom Thumb electro-magnet be marked, so that we may now inquire into the relation between the electricity and the magnetism. Fig. 193 just represents the disposition of your apparatus. Now, if we follow the current of positive electricity proceeding from the copper on its way to the spiral enclosing one end of the iron, we see that in creating a north pole of the electro-magnet the electricity flows round it in a direction opposed to the motion of the hands of a watch, whereas in creating a south pole it flows in the same direction as the hands of a watch.

Very large electro-magnets are often made, which will lift, instead of a tiny needle, many hundredweights of things. Such an electro-magnet is represented in Fig. 194, holding

weights suspended in the air. The magnet is shown by itself in Fig. 195, and consists of a round bar of soft iron, around which wire has been turned and connected with

a battery (i.e., a number of cells all joined together). The magnetism thus produced in it keeps the flat bar of iron (Δ) adhering to it, in opposition to its tendency to fall to the ground. Under the flat piece of iron there is a hook, from which a board holding weights may be suspended, as in Fig. 194, and on this as many weights may be piled as the strength of the electro-magnet will permit of. The weights will be held up as long as ever the current flows round the iron bar; but immediately the current stops down fall the weights with a tremendous bang.

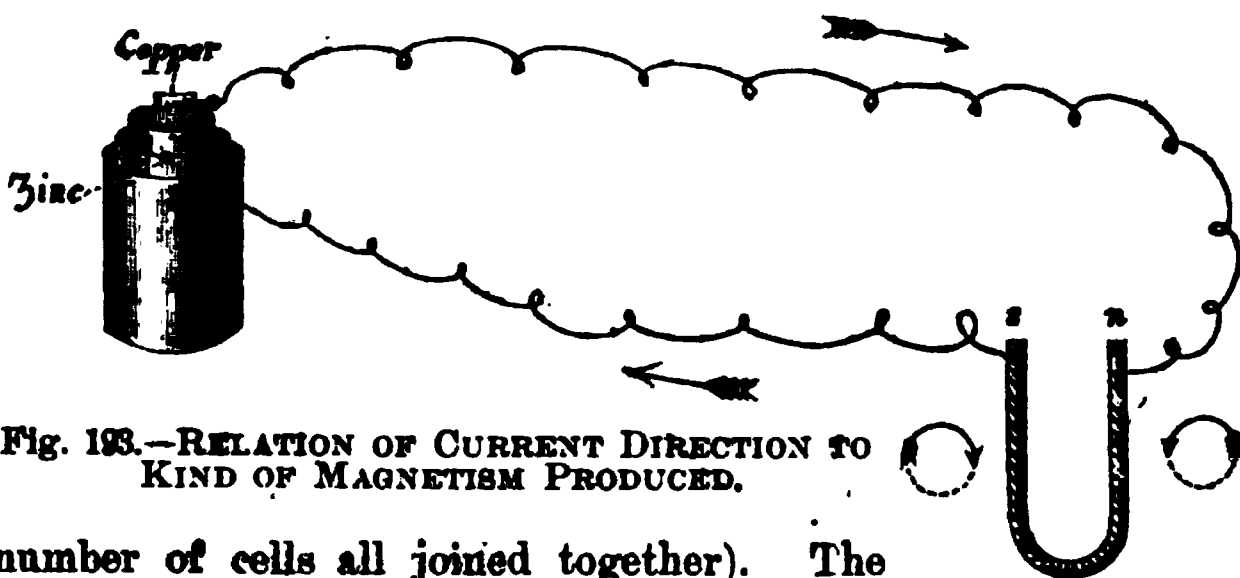


Fig. 193.—RELATION OF CURRENT DIRECTION TO KIND OF MAGNETISM PRODUCED.

PRODUCTION OF ELECTRICITY WITHOUT A SINGLE CELL.

If you wind twenty feet or more of covered wire around a large bobbin (Fig. 196), and then connect its ends ($f f'$) to your galvanometer, you will find that a current of electricity is produced when a straight piece of steel ($A B$) which has been magnetised—i.e., your bar magnet—is passed into it. A current is also produced when you take the magnet out. You will observe, therefore, that we have here just the contrary effect from what we have just studied, for we before saw that magnetism could be produced by a current of electricity, and now we see that a current of electricity can be obtained by means of a magnet. It is this latter phenomenon which takes place when one speaks into a telephone.

We may generalise what we learn in the foregoing experiment by saying that whenever a ring of wire passes through a magnet's lines of force a momentary current is generated in that ring of wire.

HOW TO MAKE A TELEPHONE.

You will require two telephones, and the materials wanted for making them will be:—(1) A pair of round steel magnets about four inches long and three-eighths of an inch in diameter. You would have some difficulty in making efficient magnets, and it is therefore best to buy a pair, which will cost about 2s. 6d.; (2) Two ounces of No. 36 silk-covered copper wire for the coils; and (3) two squares of ferrotype, which you may purchase from a photographer. The squares must be cut into circles of about two inches and a half in diameter.

And now some help may be derived from the study of the plan of a Bell's telephone (Fig. 197). The permanent magnet (M) is seen in the middle of the instrument, surrounded at one end with the coil of wire (C). The ends of the coil are carried backwards to the other end of the instrument, where they are in contact with a couple of binding screws ($b b'$), and to these screws are likewise attached the wires (w and w') which connect the instrument with the station we



Fig. 195.—ELECTRO-MAGNET.

Fig. 194.—LARGE ELECTRO-MAGNET

Fig. 196.—FARADAY'S EXPERIMENT.

are supposed to be speaking to. In front of the coil and magnet the circular plate of ferrotype is seen bound down at its edges ($f f'$), by means of the mouth.

piece (P). It will thus be seen that the instrument is not a very complex one, and in making one for yourself the same plan may be followed with advantage.

You first, then, require a case of wood, which may be conveniently made of three parts: a cylindrical part (1) for holding the magnet; a wider ring-shaped piece (2), so cut out as to permit of the coil fitting into it; and a third piece (3) fitting on to 2 with screws, its front surface being scooped into a cone-like

Fig. 192.—COMMUNICATING BY MEANS OF THE TELEPHONE.

cavity, just so as to expose at the bottom a circular portion of the ferrotype plate about the size of a sixpence. Use one ounce of wire to each telephone,

and it must be laid very neatly around a small cardboard bobbin specially made to fit round the end of the magnet.

COMMUNICATION WITH THE TELEPHONE.

Now, suppose you want to communicate with your neighbour across the street: a wire is stretched between the two houses and connected to the two telephones; from the remaining binding screw of each telephone wires are conducted, say, to the gas-pipe, and the bare wire wound round the bare pipe, so that there may be metallic contact. Conversation may now be carried on as in Fig. 198. For short distances you will perhaps find least difficulty by using a double wire instead of connecting to the brass pipe, as the joints of the latter sometimes intercept altogether the flow of electricity.

THE PHILOSOPHY OF THE TELEPHONE.

We already know that when sound-waves impinge on anything like the ferrotype plate of a telephone, such a plate is made to vibrate; and a piece of iron like this vibrating in the neighbourhood of a magnet will considerably disturb its lines of force. If these fluctuating lines of force, therefore, are crossed by rings of wire, currents of electricity will be generated in the wire. And so it is every time one speaks into a telephone, for electricity is generated and sent along the wire to the other end, in a direction which varies with the "in-and-out" action of the telephone plate. You will clearly see, then, that electricity is produced at the transmitting end. What happens where the listener has his attentive ear to the telephone? The electricity travels round the coil of the receiving telephone, and varies the magnetism of the bar within it, which in its turn varies its attraction upon the ferrotype plate; the ferrotype plate begins to vibrate, and it vibrates in such a way as to reproduce the sounds which were spoken into the transmitting end.

TELEGRAPHY.

We have seen that a current of electricity has the power to deflect a magnetic needle; and you will now find, upon experimenting with a galvanometer, that the north end of the needle turns to the right in the direction the current is sent through. You can try very easily by joining up wires to a Daniell cell. Instantly the contact is made, the needle is deflected, say, to the left; upon now crossing the one in contact with the zinc which before led to the copper, and the other in contact with the copper which before touched the zinc, you reverse the current, i.e., send it in a contrary direction from that it went in before, and now the needle swings round to the right. It is, therefore, easy to see that if you have a galvanometer in London connected with a battery, say, at Newcastle, a friend in the latter place could work the wires so as to make the needle move just as he pleased, to right or left, before your eyes in London; and if you previously agreed that so many moves to the right or so many moves to the left should mean a certain thing,

Fig. 198.—SIMPLE CURRENT REVERSAL.

then the friend at the Newcastle end would be able to speak to you in London. This is the simple principle of telegraphy, neither more nor less.

We shall now describe how to make a single needle telegraph and a current reverser, or contrivance for sending the current which way you please without having to bring the wires to and fro between the zinc and copper of the battery.

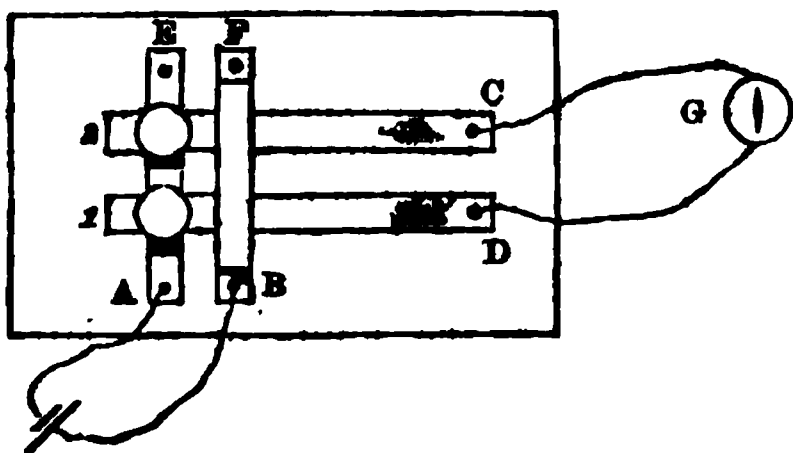


Fig. 200.—PLAN OF CURRENT REVERSER.

HOW TO MAKE A CURRENT REVERSER.

Procure a stout block of wood about two and a half inches by four inches: this will serve as a stand for the metal. Two thin pieces of brass, about three inches long and a quarter inch wide, are bent like C and D (Fig. 199), and are fixed at their ends (C and D) with screws, so that they are parallel and about half an inch apart. Another thin piece of brass, like B F, is bent four times at right angles to itself and fixed at its ends (B and F) with screws, so that the ends of C and D spring up against it and remain in metallic contact. A piece of brass (A E, Fig. 199) is now fixed to the board with screws, so that when either of the ends, 1 and 2 of C and D, are pressed down they likewise come in metallic contact with it. Knobs of wood may now be attached to C and D, for the convenience of pressing them down. The battery wires are joined up to A and B, and the galvanometer wires to C and D. They may be soldered, or, if you prefer it, binding screws may be placed at A, B, C, D. What you fail to understand from Fig. 199 will be made perfectly plain from the plan in Fig. 200, the parts being similarly lettered.

And now, suppose you have the current reverser joined up to battery and galvanometer, as in Fig. 199: you can send the current which way you please by simply pressing down one or other of the keys. If you press down key 1, for example, the current travels in the direction of the arrows marked 1; while, if you only press down the key 2, the current goes the way indicated by the arrows marked 2.

HOW TO MAKE A SINGLE NEEDLE TELEGRAPH.

This really amounts to nothing more than making a galvanometer, with coil and magnet in a vertical instead of a horizontal plane. You may, therefore, prepare a coil in the same way as you were directed for the galvanometer, leaving about six inches of wire at the ends free, and pulling the coil slightly apart in the middle, as if into two halves. Take a strip of steel, of such a size that it will readily move within the coils; soften the centre by heating it in a Bunsen burner, and then drill a hole for a pin to be fastened through (Fig. 201). You may now fix the coil (c) to a vertical board (a b), thin, and about five inches by three inches. Magnetise the strip of steel, and make a hole through the board opposite the centre of the coil, so that the needle may be fixed in the middle of the coil, with one end

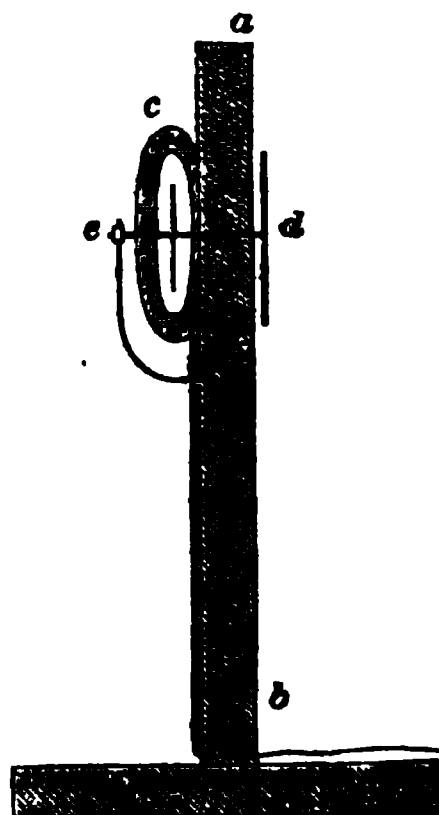


Fig. 201.—SECTION OF TELEGRAPH.

of pin (*d*) projecting through the board, and the other end (*e*) resting on a wire support. An index of light material is now attached to the end of the pin projecting in front of the board, and the wires from the coil (*w* and *w'*) are joined to wires from the current reverser. To prevent the vertical index from swinging too far little projecting stops (*f* and *g*) must be glued on each side of the top end (Fig. 202).

ABOUT SENDING MESSAGES GENERALLY.

Sending news with despatch has always been regarded as of vital importance. And in matters concerning the nation this has been done regardless of expense; as when couriers have been sent off with all speed to various parts of the kingdom, and beacons lit on every commanding prominence, to warn the people of some impending danger. This was the way more than a century ago, when ordinary news had to go at stage-coach speed. Then came the telegraph, bringing it within the means of most men to send tidings of great importance with the speed of lightning, at a rate immeasurably outstripping couriers riding on the very best steeds. And after a time, it became the recognised thing "to wire" news of many business transactions, until now it is so common that a gentleman often wires home that he will not be in to dinner. Something was still wanted; for you might stand by a telegraph clerk receiving a message and not have the slightest idea of the nature of the news coming in. It was necessary for the clerk to translate the indications of his instrument into ordinary language. What was plainly now required, then, was something to call out the news, so that it would need no translating—an instrument was wanted as wonderful in its way as the reed which told Midas's secret. The telephone was invented by Bell for this purpose. A person could now speak his thoughts into one of these instruments, and a second person, a long way off, could hear them by applying another telephone to his ear. The sounds, however, which were delivered were so weak that it was found necessary to employ a microphone and battery at the sending end. But even these exceedingly valuable ways of sending news failed under certain conditions; as, for example, where it was impossible to have a wire coming from the sender to the receiver. In cases of this sort the heliograph has been employed, within reasonable distances. But here, again, the old objection to telegraphy crops up. You might stand at the spot where news was being received, and be quite unable to make anything out of the twinkling of the distant light. You would find it necessary, again, to have it translated. Plainly, then, we require something again which will speak out, and not give us the trouble of translating. A great stride towards this end has been attained in the invention of the *photophone*, by Messrs. Bell and Tainter; and you will presently see more forcibly that this instrument bears somewhat the same relation to the heliograph that the telephone does to the telegraph. Whether it will ever attain to the same degree of practical perfection as the telephone has reached is certainly doubtful, but the time may not be far off when it will be possible to transmit speech-laden beams as far as ordinary light has hitherto been sent in the course of our National Survey work.

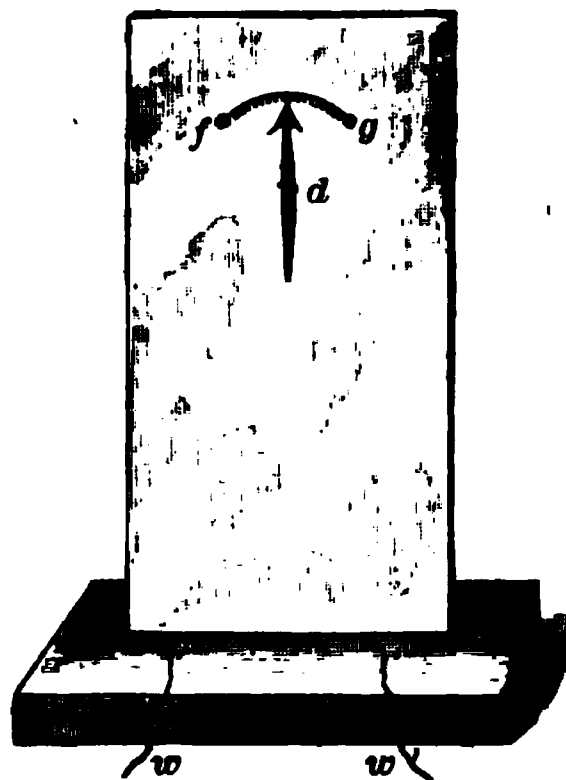


Fig. 202.—SINGLE NEEDLE TELEGRAPH.

THE PHOTOPHONE.

THE photophone is a peculiar instrument, seeing that it is acoustical, or pertaining to sound, optical, electrical, and magnetic in nearly equal proportions. And as we have to refer to the principles learnt in our study of these subjects, it has been thought best to leave the description of it until now. It consists of two parts, the *transmitter* or apparatus used for sending the message, and the *receiver* where the message is listened to. It will be understood that the only bond of union between the two is a beam of light. In operating, the sender places his mouth to a tube and speaks; a speech-laden beam travels from his instrument to the distant receiver, and at the self-same moment the man there with the telephone to his ear is told by his instrument what the speaker has said. We shall describe the receiver first and the transmitter afterwards.

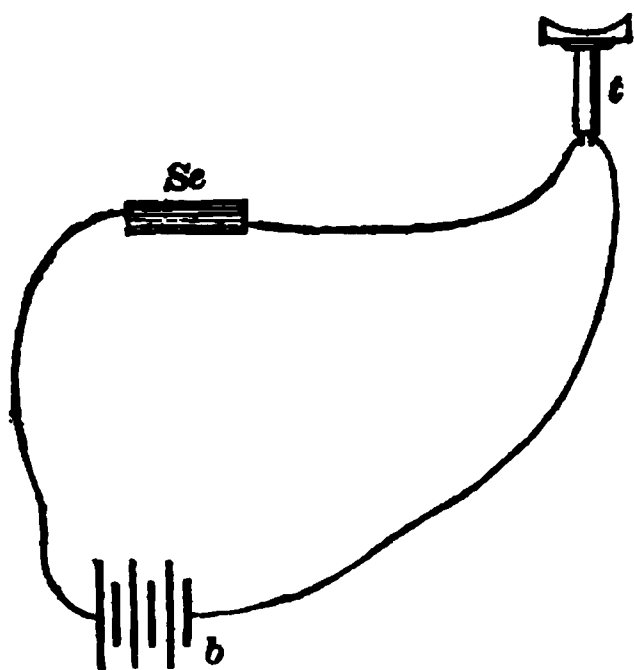


Fig. 203.—THE ACTION OF LIGHT ON CRYSTALLINE SELENIUM.

THE PHOTOPHONIC RECEIVER.

When a uniform current of electricity passes through a telephone no sound is heard. For the telephone to emit sound the current must be made rapidly variable, so that the magnetism of the bar in the telephone may in like manner vary, and thus give rise to the in-and-out movements of the ferrotype plate which affect the air and give rise to sound. This necessary variability may be given to a current of electricity by having a microphone in the circuit, which alters the resistance the current has to overcome in a wondrous manner with every sound which is produced near it (p. 423). The photophonic receiver is a kind of microphone.

From the battery (Fig. 203, b) suppose wires lead to a piece of crystalline selenium (Se), and include the telephone (t), in circuit; then, a current of electricity, in coming from the battery, will pass through the selenium and through the hobbin of wire in the telephone. No sound, however, will be emitted by the telephone if the selenium be kept in the dark, or exposed to a constant light. But such is the action of light on this crystalline selenium, that if the quantity falling on it be varied rapidly, or if light and darkness be rapidly alternated on its surface, then its resistance to the currents of electricity flowing through, varies in like manner, and sound is accordingly emitted by the telephone. Hence you will perceive that, theoretically, it is possible to produce a musical note by means of light sent from the surface of the moon, if we had a means there of creating a kind of rapid twinkle or alternation of light and no-light.

The sensitive portion of the receiving apparatus consists essentially of arms of brass (bb), separated by a very thin film of crystalline selenium (Fig. 204). The electricity, in passing through the selenium from arm to arm, experiences a variation of resistance, while variable light is falling on the element. Complicated bobbin-shaped arrangements of this kind, termed "selenium cells,"

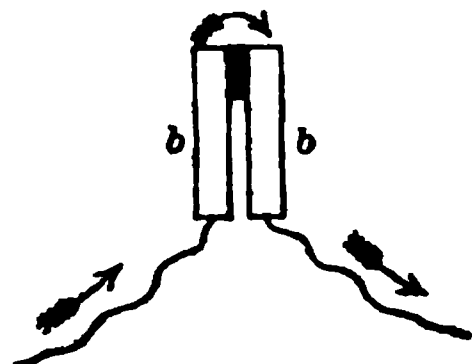


Fig. 204.—PRINCIPLE OF A SELENIUM CELL.

have been employed by Messrs. Bell and Tainter and placed at the focus of a reflector, or of a lens, so that the sound-laden beam might fall on them. A selenium cell of this sort is connected to a battery and telephone.

THE PHOTOPHONIC TRANSMITTER.

A sunbeam on its way to the selenium cell may be modified in a variety of ways. If we wish the telephone connected with the cell simply to give out

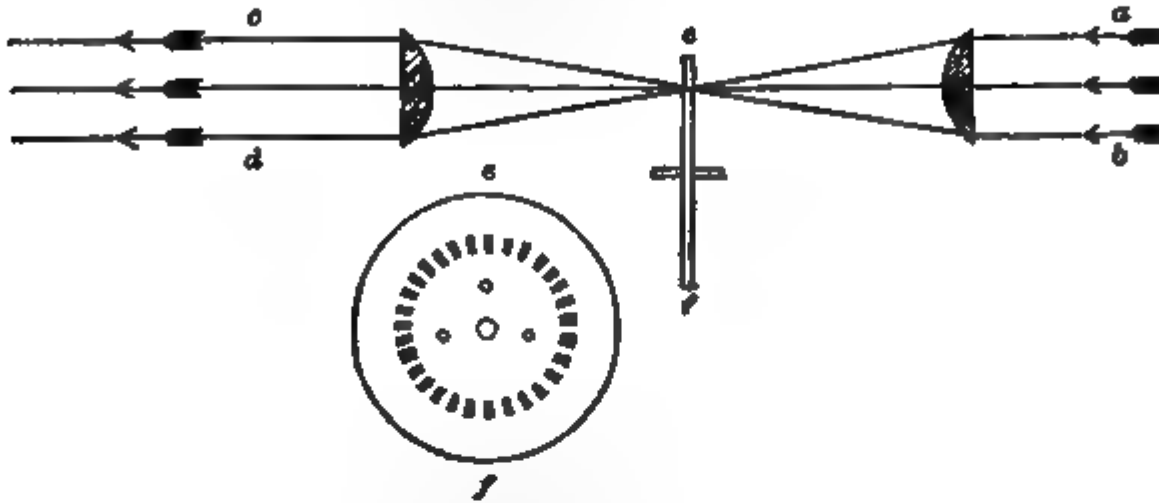


Fig. 205.—HOW AN INTERMITTENT BEAM OF LIGHT IS PRODUCED.

a musical note, the beam coming from the sun is focussed on to the holes of a revolving disc (Fig. 205, *ef*), similar to that used in the siren (p. 410), so that as this whirls round light is for one instant allowed to pass and the next obstructed.

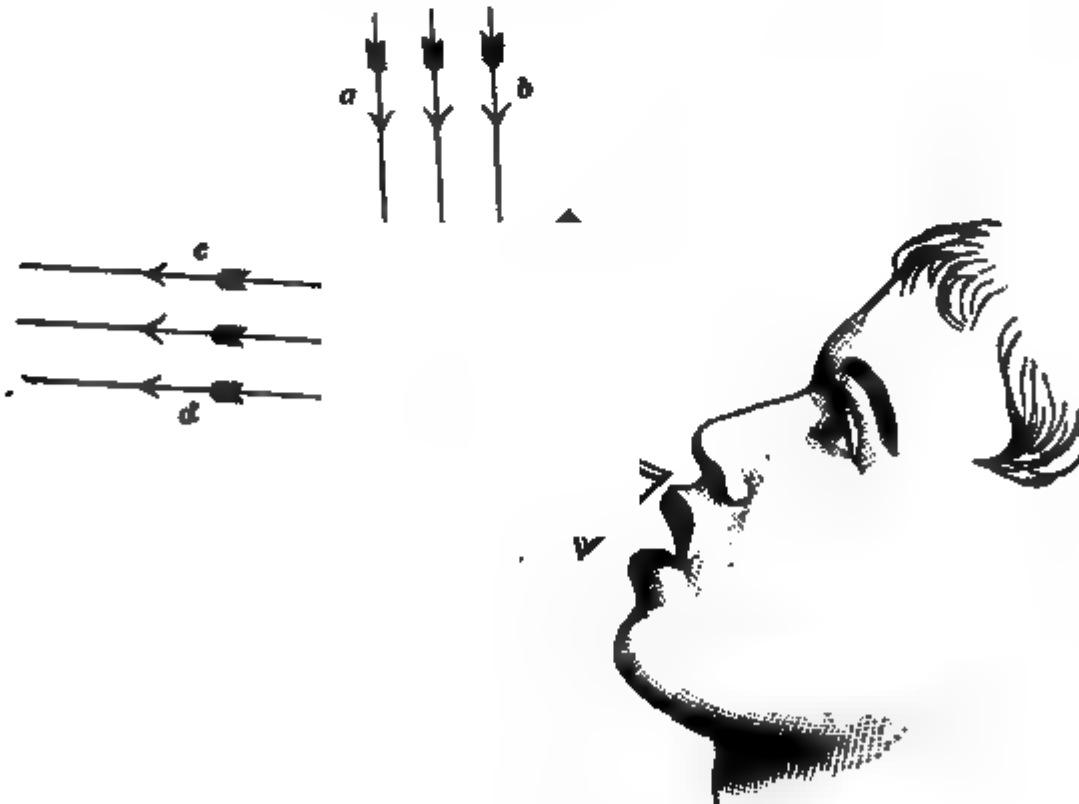


Fig. 206.—THE DIAPHRAGM MIRROR.

Another lens is now used to make the beam parallel, and from this it proceeds, a sound-laden beam (*cd*), to the distant selenium cell. The note emitted by the

telephone depends upon the speed with which the light is intermitted by the revolving perforated disc.

When speech has to be sent by means of a sunbeam, a diaphragm mirror is employed (Fig. 206). This is a thin piece of glass or mica, silvered, and placed at the end of a speaking-tube, the unsilvered portion being turned towards the tube, while the other side is used for the reflection of light falling on it. It will be understood that when one speaks into *M*, the thin mirror (*ef*) is made to vibrate just as if it were the plate of a telephone, or of a phonograph. Hence when a sunbeam (*ab*) falls on it and is reflected, the quantity of light contained within the width (*cd*) varies rapidly with each tremor, or in-and-out movement of the mirror; and this variation in quantity has a direct relation to the nature of the voice, so that the beam (Fig. 206, *cd*) may be said to be speech-laden. Accordingly, when the beam reaches the selenium cell, it produces a variation of the current passing through it, of such a nature, that the ferrotype plate of the telephone vibrates in a manner similar to that of the diaphragm mirror, and the words which were uttered at the sending end spring mysteriously into being at the receiving end.

The greatest distance that speech has been sent in this way is 700 feet, in the city of Washington, the experimenters being Messrs. Bell and Tainter.

CHEMISTRY.

A LONG time ago, when men knew nothing at all about what things are made of, they supposed that there were only four simple things in the whole world; and those four things were—the air they breathed, the water they drank, the earth they trod on, and the fire wherewith they warmed themselves and performed ordinary cooking operations. In course of time, however, they found that air consists of two very different substances; they discovered likewise that water is made up of two dissimilar bodies; and they found besides that the earth is formed from a great number of things; while fire is no substance at all, but only a change that bodies are passing through. All that they learned, and that men have since learned about these matters, is now included under the head of *Chemistry*.

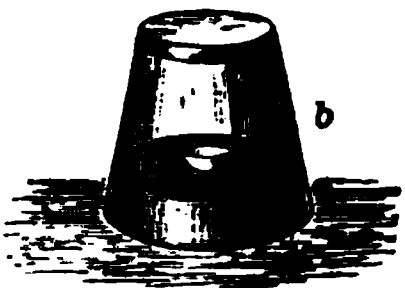
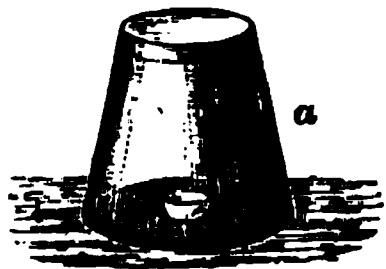


Fig. 207.—BURNING PHOSPHORUS IN AIR.

THE AIR WE BREATHE.

The air, as being one of the most common things on the surface of the earth, received a large share of their attention. But it would weary you to hear all the operations they subjected it to, and all the suppositions they framed about it, after they had begun to suspect it was not a simple substance. We must therefore content ourselves with repeating a simple and beautiful experiment they were wont to perform. Buy a stick of *phosphorus* from a chemist, and when you go to purchase it take a small bottle filled with water to put it in. Do not handle it with your fingers. Label the bottle "*Phosphorus*," and any substance you obtain in future carefully label in the same way. When you require a small piece of phosphorus for an experiment, you simply take out your pocket-knife and stick the point of the blade in it, and draw it out on to a piece of board or stone; you may then cut off a small bit for use and put the larger piece back into the bottle, quickly.

And now to perform this experiment (Fig. 207). Take an egg-shell, and break

it down until the end forms a little saucer. Float this shell-saucer in a basin full of water. Put a bit of phosphorus into the floating shell, and now, having a pretty large tumbler in one hand, with the other apply a match to the phosphorus. Immediately the phosphorus begins to burn bring the tumbler over it, with its mouth in contact with the water, so that the phosphorus burns only in the limited supply of air contained in the tumbler (Fig. 207, a). The inside of the tumbler soon becomes filled with white smoke. You ought properly to have some support under the glass, so that you can leave it awhile with its mouth still dipping in the water. You will find, after a time, that the smoke has disappeared, and that the water has risen up into the tumbler, and occupies about a fifth of the interior (Fig. 207, b). We have now to inquire what has taken place, and, in doing so honestly, we shall acquire some very interesting information.

First, then, let us examine the inside of the shell-boat. All the phosphorus is not burnt up. It would seem, then, that during the burning of the phosphorus *something* was taken from the air; and when this *something* was done, when there was no more of it left, the phosphorus went out. It is pretty evident, then, that the air we breathe consists of two parts, one of which supports combustion, while the other does not. And the experiment likewise tells us the relative proportions of these two substances which go to make up air; for we have already learnt that when any air is removed from a vessel opening into a liquid, that liquid rises to take its place, because of the atmospheric pressure. Therefore, since water has risen in the tumbler to the extent of one-fifth of its capacity, we may at once infer that the part of air which supports combustion forms one-fifth of it, and also that the part which does not support combustion forms four-fifths of it. And now we shall, for a few moments, have to turn from this experiment to take into consideration other facts which throw further light on it.

AN ACID.

You are aware that vinegar has a sour taste, and it is commonly spoken of as an *acid* substance; for the Latin word *acidus*, from which we derive ours, means sharp to the taste. Well, there are a great variety of substances which have this sour taste; but it would be highly dangerous for you to apply the tongue to all of them, as you would probably get poisoned. We require, then, a simple test by means of which you can tell an acid when you come across it. This simple test is furnished in the next paragraph.

A FLUID WHICH MAY BE TURNED RED.

Procure some red cabbage leaves, cut them up, and put them in a teapot. Now pour boiling water on them, and allow them to stand for awhile. Pour off the liquid, and preserve in clean bottles. And here we may say that you will do well to turn to account all the physic and pickle bottles you can lay hold of, only *clean them well*. In doing this you will be following the example of Sir Humphry Davy, who, when a boy, had to utilise all the spare domestic articles he could get hold of. But to return to our infusion of red cabbage. Pour some of it into a tumbler, and notice that it is nearly colourless, being only very slightly tinted bluish. Upon adding a few drops of vinegar, the solution turns *red*. An acid will therefore turn an infusion of red cabbage red, and by this property we may know it. To another portion of red cabbage infusion add a drop of *oil of vitriol*: it immediately turns red, proving to us at once that it is an acid, and chemists call it *sulphuric acid*.

THE CONSTITUENTS OF AIR.

We may now, then, return to our first experiment regarding the composition of air. The only substances which disappeared in this experiment were a portion

of the air and a portion of the phosphorus, and a cloud of white smoke was formed from them. This white substance soon disappeared, however, and it is not difficult to see where it disappeared to, for there was nowhere for it to go except into the water. The water dissolved it just as it dissolves sugar; and now comes the interesting fact. After dissolving this white substance, the water became acid; for if you take the water in the basin, and add it to our cabbage infusion, it will turn it red. To see that this is so, without any doubt, take a saucer, and after putting a bit of phosphorus on it, set it on fire, and turn a tumbler upside down on it. The white substance collects on the inside of the tumbler, and you may now add a little water to it, which will dissolve it before your eyes; and upon pouring this solution into a portion of cabbage infusion, it at once turns red. We have clearly, then, produced an acid. And it has been done by making phosphorus burn in air, and take to itself a particular portion of that air, and the white substance formed has then been dissolved. This one-fifth

of the air, then, which enters into combination with phosphorus, was regarded by the old chemists as an acid producer, and they called it by that name; for they christened it oxygen, which is a word derived from the Greek *oxys* (acid), and *gennao* (I produce). One-fifth, then, of the air we breathe is oxygen, and the remaining four-fifths is a substance entirely different, to which the name of nitrogen has been given.

AN OXIDE.

Fig. 208.—ROCK CRYSTAL.

You will clearly perceive, then, from what we have said, that the white substance we have been speaking of resulted from oxygen and phosphorus being brought together and entering into a sort of close and fast union. A substance of this sort is called an oxide. Common rust is an oxide of iron, for it contains the metal iron and oxygen; red-lead is an oxide, for it consists only of lead and oxygen, and there is a host of substances which contain, in the same way, only oxygen and another body; and such things we call oxides. Sand is an oxide of silicon; and the beautiful rock crystal (Fig. 208) is also formed of this oxide.

AN EXPERIMENT WITH AN OXIDE.

If you go to the druggist and buy a few pennyworths of *red precipitate*, he will give you a substance bearing on the packet, in addition to the name, the ominous word *poison*. It is a beautiful dark red substance of a crystalline nature, which is of very great interest to the scientific chemist, because, more than a hundred years ago, Priestley discovered that it consists of a metal and oxygen; that, in short, it is, in our modern language, an oxide. The following experiment is, therefore, one of extreme interest. Put a little *red precipitate* in the bottom of a test tube, and heat it with a spirit lamp or Bunsen burner (Fig. 209, a). You will observe first that the oxide begins to change colour, becoming darker, nearly black; and then, if you bring a spill of dry wood (c), burning slowly without flame, to the mouth of the tube, it will at once begin to burn brightly and vividly. You will see besides a mirror formed on the upper portion of the tube at b; and, if you rub a stick over this mirror, you will soon perceive that it consists of quicksilver, or

the metal mercury. The red precipitate is an oxide, therefore, which consists of mercury and oxygen; and, in this experiment, you see in another way that oxygen is a strong supporter of combustion.

TOUCH-PAPER.

Another substance which contains oxygen is nitre (nitrate of potash), and, upon heating it, some of the oxygen is liberated. You will understand, therefore, from what you have seen concerning oxygen that, when this nitre is broken up, any burning matter in the neighbourhood will keep burning. This is the secret of that steady burning of touch-paper, which you have doubtless often observed. Touch-paper may be made by soaking blotting paper in a strong solution of nitre, and then drying it carefully.

ELEMENTS AND COMPOUNDS.

Such a body as red precipitate is called by the chemist a *compound*, because it is possible to split it up into simpler substances. Rust is a compound of iron and oxygen, and the white substance we have spoken so much about is a compound of phosphorus and oxygen. Now, by no means that we have yet discovered, can we split up oxygen into anything else but oxygen, or nitrogen, phosphorus,

iron, and mercury into anything else but these bodies. Simple substances, like these, are, therefore, known to us as *elements*; and, so far as we know, they are elements in the strictest sense of the word, and thus very unlike the so-called elements known to the ancients. There are more than sixty elements, and all the substances the world is made of consist of various combinations of them.

Among the more common elements

we have four gases: oxygen, hydrogen, nitrogen, and chlorine; the metals iron, mercury, tin, zinc, gold, silver, copper, platinum, potassium, sodium, aluminium, and calcium; and the non-metals bromine, iodine, carbon, phosphorus, and sulphur.

Fig. 210.—MAKING OXYGEN.

SOME EXPERIMENTS WITH OXYGEN.

To get a quantity of oxygen for experimental purposes, procure some chlorate of potash and powder it; mix well with fine oxide of manganese, and place the mixture in a saucer, to be dried well before using. The mixture may now be put in a flask, from which a delivery tube leads under the surface of a jar filled with water (Fig. 210). The flask is now heated strongly. After a time, the oxygen begins to come off very rapidly, and the jar is soon filled; another ought to be in readiness close by, so that no gas may be wasted. Let us suppose, then, that you have obtained a couple of jars full of oxygen. You may now perform a couple of brilliant experiments. Procure a piece of brimstone, to burn in the oxygen. You require first a piece of cardboard (Fig. 211, a b), which may be used



Fig. 209.—BREAKING UP AN OXIDE.



Fig. 211.—BURNING BRIMSTONE IN OXYGEN.

to replace the glass cover of the jar; and, having pushed a piece of wire through this, its lower end must be twisted into a close spiral, so as to form a small cup (Fig. 211). Place a bit of sulphur in the cup and set it on fire; it will begin to burn with a faint blue flame in air, likewise giving off, at the same time, a something with a most suffocating odour. Quickly remove the glass plate from a jar of oxygen, and replace it with the card cover *a b*. Now, the sulphur flame is quickened into life, for it burns most vividly, whereas, before placing it in the jar of oxygen, it had only a feeble flame. If, after this experiment, you pour a little fresh water into the flask, and rinse it round, you will find that it possesses acid properties.

And now, as this testing for acids is a most frequent operation with us, it would be very convenient if we could manage it in a handier form than having to use an infusion of red cabbage each time. You may, therefore, buy at the druggist's a small book of litmus paper for twopence or threepence. The leaves are of a blue colour; and, when you want to test anything, you take a small portion of one of them and dip it into the solution. If the solution be acid, it will at once turn the blue litmus paper red, even as it turned the colour of our red-cabbage infusion. Upon testing the water in the jar, after burning sulphur in it, the blue litmus paper is turned to a decided red.

Sulphur and oxygen have evidently combined to form an oxide, and this oxide is known to chemists as *sulphurous anhydride*. It is a transparent gas, so that you cannot see it; but your nose soon tells you of its presence, as it possesses an exceedingly pungent odour. It is also very soluble in water, and the solution acts like an acid.

And now, having cleaned our wire cup, if it be still all right after the sulphur experiment, we may use it for another of a similar nature. You must, this time, place a bit of charcoal or carbon in it, and, having just managed to make some portion of the charcoal red hot, you may quickly introduce it into a jar of oxygen as before, when you will produce a most brilliant display, and soon all the carbon will have burnt away; or else, if there be too much of it, there will not be enough oxygen to burn it up. In this experiment, oxygen and carbon are brought together, and, consequently, an oxide of carbon is formed. This oxide of carbon is generally known as *carbonic acid*, and chemists call it *carbonic anhydride*. It will be found, upon washing the inside of the bottle with fresh cold water again as before, that the blue litmus paper gives a feeble acid reaction.

MANIPULATION.

In the preceding paragraph we required apparatus of a more complicated kind than any we had used before for chemical purposes. It will be as well, then, now, to inquire how such apparatus is made, or repaired when broken. If you desire to become a first-rate experimenter, a knowledge of manipulation is absolutely essential, and must be acquired by much practice. Would the book-binder's boy have ever become Faraday the physicist, or the apothecary's assistant Sir Humphry Davy the chemist, if they had not striven hard as lads to make themselves everything they wanted? Certainly not; and although we cannot all become Faradays or Davys, if we acquire the power to put our ideas into practical form, it will certainly become a source of pleasure to ourselves and friends, and maybe of profit. We will suppose, then, that we have an experiment to make which requires a certain piece of apparatus. Having settled the form this apparatus shall take, a rough sketch of it is committed to paper. This is our plan. Now, in thinking over how this plan has to be worked out, we shall soon see that in ninety-nine cases out of a hundred it resolves itself into bending a few pieces of glass, working cork, blowing bulbs, or etching scales, and when

the requisite parts are made of their proper shapes, we adjust them to each other, and thus make the instrument we require.

The Tools required.—Cork is so different in its nature from ordinary wood that you could not well use a gimlet for boring it. Thin hollow cylinders of brass, with their ends quite sharp, are therefore used. They are worked into the cork like the ordinary gimlet, and the cork which is cut out passes up the inside of the cork-borer. A set of six cork-borers will be found very useful, and also a rat's-tail file for filing the inside of the hole made in the cork. A Bunsen burner is also very essential, and also a blowpipe, which for a start may be a little ninepenny Black's blowpipe. You will, moreover, want half a foot of platinum wire; a pound or two of glass tubing, mixed bore; a lot of good corks; and a retort stand, say eighteen inches high, with three rings.

To bend a Tube (Fig. 212).—One of the first things the tyro has to learn is to bend a glass tube properly, and make it fit for any given piece of apparatus. Suppose, then, we have to take from a long rod of glass tubing a piece six inches long. We carefully measure off the length, and having nicked it by means of a small file, we apply the two thumbs to the nick, nail to nail, and snip it in two. The straight piece of glass will have sharp cutting edges at its two ends; these have to be rounded off by holding them in turn in a gas flame until they become red hot, when the cutting edges soon settle into well-rounded ends. Suppose, now, we have to bend the piece of glass at right angles in the middle. The portion of it that has to be softened is gradually brought into the flame; it becomes smoked, and then red hot, all the time the manipulator is keeping it rolling, as it were, between his fingers. The tube at last begins to bend slightly, and now the operator has to try so to bend it that this portion of the tube, after the thing is done, is no thinner than the other parts of the tube. The bend being effected, it has next to be held in the flame, so that it may be smoked before being laid down. A few attempts of this sort will lead to success, and we may add that these attempts ought to be persevered in until the beginner has got the knack of doing the thing well, for nothing looks worse to the eye of a chemist than a piece of apparatus with tubes that are unevenly bent, as his early experience has taught him that they are not only unsightly, but also untrustworthy.

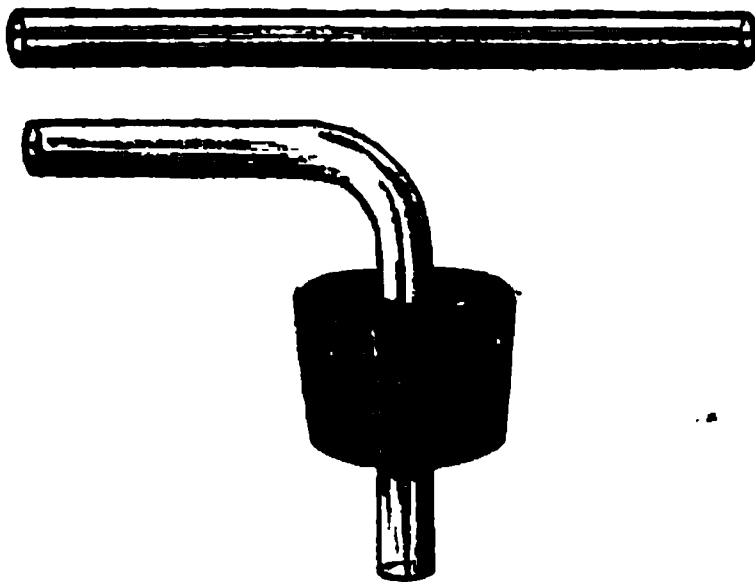


Fig. 212.—HOW TO BEND A GLASS TUBE.

To fit into a Cork.—Having picked a good cork, a borer must be chosen out of the set, whose diameter is somewhat less than the width of our bent tube; and a hole must now be pierced through the cork by using the borer much in the same way as you would a gimlet. If it be wetted its progress through the cork will be much easier. The glass tube will probably not go through the round hole in the cork yet; the hole is therefore made a very little bigger by filing with a rat's-tail file, and the end of the tube is wetted. If it can now be thrust through so as to be tight when in position, we shall have satisfactorily finished our little task.

Before boring corks they ought to be wrapped up in paper and rolled with some pressure under the foot, so as to soften and make them more ready to fit into flask or tube.

To make a Constriction in a Tube (Fig. 213.)—It is very often necessary to have a constriction, or narrowing, in a tube; and much sometimes depends upon

this being done well. After softening the tube at the proper place, pull its ends slightly apart, and, in the meantime, be



Fig. 213.—HOW TO MAKE A CONSTRICTION IN A GLASS TUBE.

playing on the narrow portion with your blowpipe. The glass at the narrow place thickens; and, if the operation be left off at the proper time—and the operator must here, of course, trust to his own judgment

—a good strong constriction will have been obtained.

To Blow a Bulb (Fig. 214).—Play on the end of the tube where the bulb is required with a blowpipe until it is sealed up; or, if the tube be one of large bore, a constriction had better be made in it, and the unnecessary portion pulled off. The sealed end is then made quite soft by means of the blowpipe, and the operator now quickly applies the open end to his mouth and blows until the bulb is formed.



Fig. 214.—TO BLOW A GLASS BULB.

To make a Round Hole in the Side of a Tube (Fig. 215).—One end of the tube is well corked up. And now the portion of the tube is warmed where the hole is wanted, and then heated in a gas flame, and finally a fine jet of flame from the blowpipe is played on to it. It softens. Now blow vigorously down the unclosed end; a bulb is formed at the side, and burst. The

thin glass, so thin that it may show soap-bubble colours, is now knocked off, and the cutting edge of the circular opening is melted into a well-rounded-off edge.

To place a Platinum Wire in a Glass Tube (Fig. 216).—This is an operation which is often necessary, and, very fortunately, it can be easily and successfully performed. Platinum and glass expand and contract nearly at the same rate, which is an extremely lucky thing for chemists, because, if this were not the case, the glass would break in the process of cooling directly after you had placed a wire in it. Thus you must proceed, then: Take the tube and make a constriction near one end, as at *a*. Now draw away the lesser end portion by fusing a piece of glass into it and pulling until the end of the piece of tube you require is drawn out as at *b*. The pointed end may be now snipped off

Fig. 215.—TO MAKE A HOLE IN THE SIDE OF A TUBE.

and the piece of platinum wire inserted as at *c*. Upon now heating *c* in the blowpipe the glass will close in on the wire, and the latter will then be firmly fixed in the tube.

To make a Delivery Tube.—This portion of a gas generating apparatus is so easily made that one has scarcely any need to mention it. Having measured the length of tubing you will require, you fix one end into the cork of the generating flask, and this tubing will then want bending according to your requirements, as already explained and illustrated.

Connecting Tubing.—It is often necessary to connect one piece of glass tubing to another in the construction of apparatus. This is done with extreme ease, by having indiarubber tubing of about the same bore; a small bit—say about an inch long—being slipped on

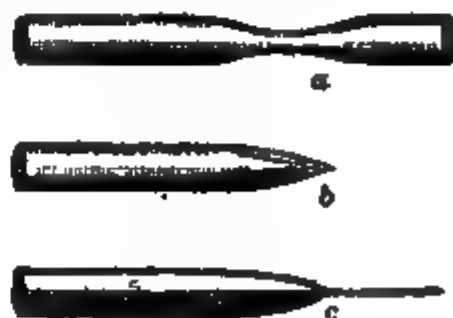


Fig. 216.—GLASS TUBE WITH PLATINUM WIRE IN IT.

to the two ends which have to communicate with each other. In the majority of instances, this will be all that is required. You may, however, fasten each end securely on with twine; or, if the arrangement be one of a permanent nature, with very thin copper wire, afterwards twisting the ends of the wire quite fast and secure, as at *a* and *b* (Fig. 217).



Fig. 217.—TO CONNECT TUBING.

Catching Gases.—Before proceeding farther with our experiments, it is necessary to say a word or two on this subject. If you take a bowl full of water, and place a tumbler in it, the glass vessel soon fills, and would sink to the bottom. Now take hold of the bottom of the tumbler and lift it up with its mouth downwards (Fig. 218); as it emerges from

the water it will remain full, so long as its mouth remains just under the surface of the water (*B*) in the bowl, and you have thus a quantity of water (*A*) in the tumbler above the level of that in the bowl. Any light substance placed now, under the mouth of the tumbler, will rise above *A* and displace a quantity of water equal to it in bulk. Hence, when you pass

Fig. 219.—PNEUMATIC TROUGH.

a gas like oxygen under *A*, by means of a delivery tube, the tumbler is soon filled, and all the water expelled. This is a very convenient way of catching gases, and may be employed when the gas does not dissolve in water. Instead of the bowl, it is customary to employ a tin trough (Fig. 219), which has a shelf (*a b*) perforated with a few holes. When the trough is filled with water, the jar or tumbler is sunk in it, and then lifted on to the shelf, with its mouth over one of the holes.

Fig. 218.—CATCHING GASES.

The end of the delivery tube is now passed under this hole, and the gas rises through it and soon fills the glass vessel.

In filling long jars, one has some trouble sometimes in keeping them from toppling over, and an upright piece of wire (*c*) soldered to the trough and ending in a ring, will be very useful as a support (Fig. 219).

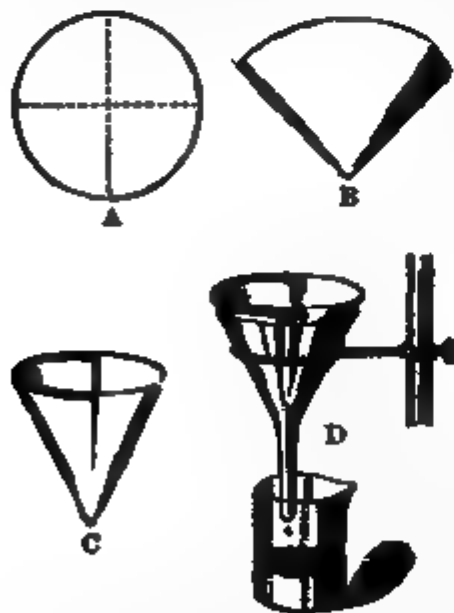


Fig. 219.—FILTERING.

THE TEST FOR CARBONIC ACID.

Procure a lump of quicklime, the chemical name for which, by the way, is oxide of calcium, because it is a compound of oxygen and the metal calcium. Put the lump into a basin, and pour water over it. The water combines with the lime, and, after a time, you will perceive nothing scarcely but a white powder. You will observe during this operation that very much heat is produced. Now add more water, and filter. The clear solution which comes through

is lime-water; bottle it, say, in a physis bottle, and put on a label, with the name *calcic hydrate*, for this is the chemical name for it.

And now, if you take some of this calcic hydrate, and pour it into the jar where carbon has been burned in oxygen, you will find that the clear liquid very

soon becomes milky. This would not have happened had you poured the lime-water into the solution of sulphurous anhydride. This milkiness, then, which results when a solution of carbonic acid, or even carbonic acid gas itself, is passed into clear lime-water, is regarded as an evidence of its presence.

HOW TO FILTER.

The operation of filtering, which we have just referred to, is an exceedingly simple one. A piece of white blotting paper is cut into a circle (Fig. 220); and now it is doubled up into halves, and then into quarters; so that now, upon opening out two of the quarters, a sort of hollow cone is produced, which will fit nicely into a glass funnel. After placing within the funnel, it is just dampened with a few drops of water, so as to make it adhere. And now the liquid which requires filtering is gently poured into the funnel, the suspended material remaining behind on the paper, while the clear fluid passes slowly through.

CARBONIC ACID IN THE BREATH.

Pour a small quantity of the clear calcic hydrate into a clean glass tumbler, and now blow your breath through the lime-water, either by means of a pipe-stem or a glass tube. You will soon perceive, as you keep blowing away, that the lime-water becomes milky, thus showing us that there is carbonic acid in the breath (Fig. 221). Where has the carbonic acid come from? This is a little matter for us to investigate. To begin with, then, the carbonic acid either comes from the lungs or the atmosphere, or from both. If, therefore, we can reverse this experiment—i.e., breathe no air except what has passed through calcic hydrate—then, if there be any appreciable amount of carbonic acid in the air we breathe, it ought to show itself. Suppose, then, you fit up a bottle with a cork through



Fig. 221. — MAKING CHALK WITH THE BREATH.

which two tubes have been passed (Fig. 222), one (*a*) which reaches nearly to the bottom, and the other (*b*) which only goes just below the under surface of the cork. You may now fill the bottle half full of calcic hydrate, and you will find, upon drawing your breath through the tube (*b*), that you produce no milkiness, although you breathe, in this fashion, much longer than you blew your breath into calcic hydrate before. It is apparent, therefore, that the carbonic acid you give off comes from the lungs, which may be proved, with the same apparatus, by removing the mouth to *a*, and blowing the breath down the tube.



Fig. 222. — ANALYSIS OF THE BREATH.

It would appear, therefore, that we are continually carrying on a sort of combustion in our bodies; for we breathe in air containing oxygen, and we breathe out air containing carbonic acid, which has been formed during the purification of the blood, by the union of oxygen with waste carbonaceous matters. You thus see the use of fresh air, containing its full quantity of oxygen, in preserving health; for if the atmosphere be spoiled by the presence of too much of the gases given off in various manufactures, the oxygen in the air being diminished, the blood is not sufficiently purified, and health gives way.

HOW TO MAKE A QUANTITY OF CARBONIC ACID.

It would be highly inconvenient to have to make carbonic acid by burning carbon in oxygen, and it is, therefore, made as follows (Fig. 223):—A round cork is fitted into a pickle bottle, and it must have two holes bored into it, one for a delivery tube and the other for a small funnel tube. Some bits of marble are now placed in the bottle and covered with water, so that the end of the funnel-tube dips just below the surface of it. And now spirits of salts, also known as muriatic acid and hydrochloric acid, is poured down the funnel until the gas is freely disengaged. You may then catch a jar full over water, or you may pass the delivery tube to the bottom of a jar standing on its bottom, because carbonic acid is so heavy that it will displace air just as water displaces it when you pour some into an empty vessel.

Fig. 223.—MAKING CARBONIC ACID.

If you now take a lighted taper and put it into carbonic acid gas, you will find that it is extinguished. Carbonic acid, therefore, does not support combustion, and as life is a sort of combustion process, it likewise will not support life. So that when carbonic acid has, by some means or other, collected at the bottom of deep wells men have often lost their lives by going into it. It would have been an easy matter for them to see whether the atmosphere at the bottom of the

Fig. 224.—SOAP BUBBLE IN CARBONIC ACID.

well was fit for them to enter, by lowering a lighted candle down to the bottom. Upon such an occasion if the candle goes out there is danger, but if it keeps in it is quite safe. The gas is soluble in water, and at 0° C.—that is, the freezing temperature of water—a pint and three-quarters of it will dissolve in a pint of water. But you drive it all off by boiling. Many natural springs are impregnated with the gas, as, *s.g.*, at Carlsbad, Bilin, and Wildbad.

You may float a soap bubble on the surface of carbonic acid contained in a basin, and as the gas is transparent and invisible the bubble appears to float on nothing (Fig. 224).

THE BREATHING OF A PLANT.

If you examine the surface of a leaf with a microscope, you will find little openings (Fig. 225) here and there,

Fig. 225.—MOUTHS IN A LEAF.

which are mouths to drink in air. But these plants are unlike animals, for the portion of the air they require is just that which would kill animals, viz., the carbonic acid. They suck this carbonic acid in, and the green colouring matter, called *chlorophyll*, which you see in the leaf, has the power to break the carbonic acid up when aided by sun-light. It tears the carbon from the oxygen; and while the latter, which is requisite for animals, is given back to the air, the carbon is taken by the tree to itself, so as to help it to grow. The plant also receives nutriment by way of its roots; but this we must speak about farther on (p. 552).

HOW TO TELL THE AGE OF A TREE.

A moment's consideration of what we have just said concerning the breathing of plants will show you that during one period of the year plants are deprived of an important portion of their nutriment, for, on the approach of winter, the leaves fall off. It would thus appear that each annual increase is separated, as it were, from the increases of years

before and after. When a tree is sawn in two, you see, therefore, a number of concentric rings, and upon counting them up the age of the tree may be ascertained. In the accompanying diagram (Fig. 226) of the section of an oak, eighteen years old, you will see that there are eighteen rings.

HYDROGEN.

And now we may turn for a few minutes to consider the lightest of all known gases, which is also invisible and transparent. You may prepare it with the same apparatus you used in making carbonic acid. Place scraps of zinc in the bottle, cover with a little water, and now, when the funnel tube dips into it, pour through it some hydrochloric acid. Hydrogen will begin to rise from the surface of the liquid at once, and if you want it to come off fast, you add more acid by the funnel. After sufficient time has elapsed for the air within the bottle to be all



FIG. 227.—HYDROGEN DISPLACING AIR.

expelled, you may now bring the delivery tube under an inverted jar filled with water. The gas is so very light, that you may even fill a jar by holding it mouth downwards, and passing the gas up to the top, where, by reason of its lightness, it will displace the air (Fig. 227).

Take a jar of the gas with its mouth downwards, and rapidly pass a lighted taper up into it (Fig. 228). The taper is put out, but the gas at the mouth of the jar burns. We are taught two things by this simple experiment, for we learn, from the fact of the taper being put out, that hydrogen does not support combustion, and farther, from the blaze at the mouth,

that hydrogen burns in air. Now, as we have already seen, when a substance burns in air, such as carbon, e.g., we have an oxide formed, therefore we shall



FIG. 228.—HYDROGEN BURNING.

probably have an oxide of hydrogen produced in this experiment, and we may as well at once anticipate matters by saying that this oxide of hydrogen which is produced goes by the very common name of *water*.

HYDROGEN IN THE SUN.

It is not unreasonable to suppose that the sun, moon, and stars have substances in them such as the chemist is continually studying. And in many cases we can actually prove that it is so, as we have already described in speaking of the spectroscope. Now among astronomers there was, for a long time, a great wish to know what the red prominences might be which are seen when the sun is eclipsed. Here, for example, in this diagram (Fig. 229) which represents the eclipse of the sun in 1842, you see three pro-

minences extending out of the black disc; these prominences are of a ruddy colour. When their nature was inquired into by means of the spectroscope it was found that hydrogen was most certainly in them, so that we can say, without fear of contradiction, that there is an enormous ocean of glowing hydrogen on the sun's surface.

Fig. 229.—ECLIPSE OF THE SUN.

THE COMPOSITION OF WATER.

That water is produced when hydrogen is burned is readily shown (Fig. 230).

Fig. 230.—BURNING HYDROGEN FROM A JET.

Suppose that the materials for making hydrogen are in A (Fig. 230)—namely, zinc, water, and hydrochloric acid—the gas may be passed along the tube B, into the

vessel C, containing fragments of lime, which will dry the hydrogen, and now, if the dry gas be conducted along the tube D drawn out to a jet at its end, when lit it will burn with a hot non-luminous flame, and in burning it combines with the oxygen of the air to form water. To prove this, bring a perfectly clean and dry bell-jar over it: soon its surface will be covered with dew or condensed water vapour. Be careful in performing this experiment that you do not light the jet too soon, otherwise you may have an explosion. And we may further add that you need not go to any extra expense in making this experiment, for instead of the bell-jar at D you may use a clean dry tumbler; C you may make yourself, and the apparatus for generating the hydrogen may be the same as that used before. The diagram will serve, however, to show you how you ought to dispose of the various pieces of apparatus you are using. This way of making water by putting together hydrogen and oxygen is called *synthesis* by chemists, from the Greek word *synthesis*, a putting or placing together.

The composition of water can be shown, however, in a variety of ways; you

can, for example, decompose it by means of electricity (Fig. 231). A vessel (A) contains water which has been acidulated with sulphuric acid, two plates of platinum stick up in the fluid on either side of A, and over them a couple of test tubes are inverted, quite full of the liquid. Now the platinum wires pass through the glass vessel, and are connected with the poles of a battery (p. 516). Bubbles of gas begin to rise from each pole and fill the tubes. The two tubes are filled at different rates, for it is soon evident that the gas contained in one of the tubes is twice the volume of the gas contained in the other. Upon testing the gases, the one of lesser volume is found to be oxygen, and the other is proved to be hydrogen. In this experiment we learn not only that hydrogen and oxygen go to form water, but we also learn the proportions of each, viz., one measure of oxygen to two measures of hydrogen.

Fig. 231. — DECOMPOSITION OF WATER BY ELECTRICITY.

THE COMPOSITION OF WATER INDIRECTLY SHOWN.

Besides the direct ways of proving the composition of water, there are a number of ways in which it is indirectly shown. For example, the metal potassium has so strong an attraction for oxygen that it will even rob water of it, so that when you throw a bit of the metal into water it rushes up and down on the surface, seizing the oxygen to itself, and liberating the hydrogen. So much heat is likewise produced during the experiment that the hydrogen begins to burn, and you have what appears to be water set on fire. This is a striking experiment, and at any time, where you think water is produced, you may test it by adding a bit of this potassium.

AN ALKALI.

When the potassium combines with oxygen, an oxide is formed as usual, which is very soluble in water, but if you test the water now with litmus paper it does not turn red; and you will find that if you dip a bit of litmus paper into it, that has already been reddened by acid, the redness disappears, and the blue colour is restored. The acid has evidently been neutralised; and substances which can neutralise acids in this way are called *alkalies*.

Spirits of hartshorn or ammonia is a strong alkali; so that you may readily restore the blue colour back to reddened litmus paper by means of it.

CHANGE OF COLOUR PRODUCED BY COLOURLESS FLUIDS.

If you now take the infusion of red cabbage, you may perform with it what will appear to your companions to be a magical trick. Pour two wine-glasses full of the infusion, and now to one add a few drops of sulphuric acid, it turns red; to the other add a few drops of the solution of oxide of potassium in water, it turns green; and you may now remove the colour from either by adding alkali to the acid solution, and acid to the alkali solution.

CHLORINE.

A little while ago we mentioned four common gaseous elements, and one of them, viz., chlorine, we have got to experiment with. It is an element we take into our systems every day, just as we take oxygen and hydrogen, for common salt, of which we use so much with our food, contains a great amount of chlorine. It is transparent like the other gases we have studied, but it is not colourless, for when you have made some you will see clearly that it is of a greenish tinge, and because of its colour it was named chlorine, from the Greek, *chloros* (grass green). It has a most disagreeable smell, and if breathed in quantities it is exceedingly dangerous, and may cause one's death.

Fig. 232.—MAKING CHLORINE.

HOW TO PREPARE CHLORINE.

To prepare the gas you take one part by weight of common salt, one part of black oxide of manganese, and mix in a large flask with two parts of sulphuric acid and two of water (Fig. 232). The gas will begin to come off with a very slight heat. It is very soluble in water, so that it would cause a great waste of the gas to catch it over water in the usual way. It is therefore collected by displacement of the air, as it is about two and a half times heavier than it; therefore, if the delivery tube reaches to the bottom of the jar the chlorine will gradually displace the air as the jar fills.

STRIKING EXPERIMENTS WITH CHLORINE.

Fig. 233.—BURNING A METAL IN CHLORINE. Chlorine combines with the metals to form chlorides, just as oxygen unites with them to form oxides, and in combining with the metals some brilliant effects are produced. If you take a jar filled with chlorine, and sprinkle into it some

finely-powdered antimony, you will observe a sort of fiery shower, which results from the powdered metal and chlorine uniting with great force to produce the chloride of antimony (Fig. 233).

Phosphorus will take fire of itself in chlorine gas, burning with a pale and feebly luminous flame. If you take a piece of paper and wet it with oil of turpentine you will now find, upon thrusting it into a jar of chlorine, that the element attacks the hydrogen contained in the oil of turpentine with such violence that it at once breaks out into a very smoky flame. This experiment with turpentine illustrates the action of chlorine on what are called organic substances (p. 547), so that you will perceive that if some unfortunate individual were to get his mouth full of this gas, his destruction would arise from the tissues of his inside being decomposed.

THE MUTUAL LIKING OF CHLORINE AND HYDROGEN.

We have seen that hydrogen has a remarkable tendency to combine with oxygen. It also shows the same desire to unite with chlorine, so much so, in fact,



Fig. 234.—COMBINATION OF HYDROGEN AND CHLORINE.

that if equal measures of these gases, mixed together, be exposed to the action of diffuse daylight, they form a compound gas called hydrochloric acid. If, however, the light be very strong, such, for example, as you obtain when you burn magnesium wire, then the two gases combine with great violence. The latter experiment is illustrated in Fig. 234, where a glass vessel containing the mixed gases is placed under a wire screen while a piece of magnesium wire is being burned. The thin glass vessel will be shivered into a thousand pieces, hence the necessity for its being covered.

HOW TO BLEACH.

Bleaching powder is a substance which contains chlorine, and the gas may be liberated from it by the addition of a weak acid, like diluted sulphuric acid, for example. Now, owing to this property chlorine has of destroying organic matters, it is sometimes used to destroy organic colouring substances.

Suppose, now, you have a piece of cloth dyed with some organic dye, and you want to bleach it, this would be your method of proceeding. You first mix a small quantity of bleaching powder with warm water, and filter. The dyed material is now washed in the filtered solution. You have beside you a basin containing very dilute sulphuric acid, and in this you rinse the material you have just taken out of the bleaching powder solution. This operation is repeated for several times, until you have got all the colour out.

When the material, with bleaching solution on it, was transferred to the bath of dilute sulphuric acid, the chlorine of the bleaching powder was liberated in the presence of the water. It robbed the water of its hydrogen, and the oxygen, newly set free, then combined with the colouring matter of the dye, to form a new and colourless compound. This is how it is supposed the bleaching operation proceeds.

HOW TO IGNITE A PIECE OF PAPER WITHOUT MATCH OR ORDINARY FIRE.

Now, chlorine, besides combining with metals, to form chlorides, also combines rather loosely with oxygen; for, it would seem to be a general rule that,

where substances are remarkably unlike each other, as, for example, metals and chlorine, the compounds formed by their union are remarkably firm and not easily to be destroyed; while, on the other hand, where the substances are somewhat akin in their general qualities, like chlorine and oxygen, then, if they can be made to unite, their union is very feeble, and they may at any moment dissolve partnership in the most violent manner. What is known to chemists as chloric peroxide, is a compound of chlorine and oxygen of this sort. Its preparation is attended with no small amount of danger, but the following experiment may be tried without fear, and it is exceedingly striking.

Powder some chlorate of potash and sugar, and mix them well together. If you now take a paper spill, and put on it a little of this mixture, you only require to touch the mixture with a drop of sulphuric acid, from the end of a glass rod, and the paper will instantly be set on fire (Fig. 235). And now, if you want to have a remarkable and harmless blaze-up, place the remainder of the mixture on a plate in a conical heap, and touch it, as before, with a drop of oil of vitriol (sulphuric acid) from the end of a glass rod. There will be a great and momentary blaze instantly.

What happens in this experiment is the production of chloric peroxide, along with other bodies, by the action of the sulphuric acid on the chlorate of potash. Instantly the peroxide is liberated, and comes into contact with the sugar, the partnership existing between the ill-sorted oxygen and chlorine is dissolved; or, in chemical language, there is violent decomposition.

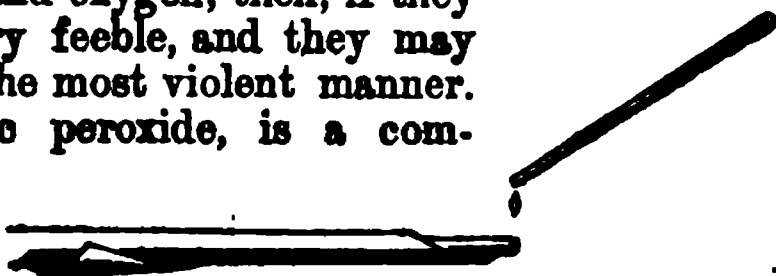


Fig. 235.—IGNITING PAPER WITH A COLD-SUBSTANCE.

TWO ELEMENTS THAT ARE RELATED TO CHLORINE.

As we have before hinted, there are remarkable similarities among some of the elements, as well as dissimilarities; and, of the former, there is, perhaps, no more striking resemblance among elements than that which exists between chlorine and the two elements bromine and iodine. Just as you prepared chlorine,



Fig. 236.—FLASK FOR IODINE VAPOUR.

so may you prepare these two substances, making due allowance for the fact that bromine is a liquid and iodine a solid. For example, we made chlorine by heating a mixture of common salt, sulphuric acid, and oxide of manganese. Now, if instead of common salt, which is chloride of sodium, you use bromide of sodium, then you obtain the element bromine; and if, instead of salt, you substitute iodide of sodium, then you would obtain iodine. And so it is in nearly every other chemical action. Thus you might take the three substances, chloride of potassium, bromide of potassium, and iodide of potassium, all of which are very much alike in external appearance, and dissolve them in separate portions of water, and you would find that, upon adding a few drops of a watery solution of nitrate of silver to each, there would be a white substance formed in each case, the first being chloride of silver, the next bromide of silver, and the last, rather yellowish, iodide of silver. All these three substances are acted on by light, and changed in some way by the magic action of those very tiny ether waves, which are so in-

strumental, along with the green matter in leaves, in decomposing carbonic acid. If you place a few grains of iodine in a flask, and then draw out the neck,

upon heating it, it will form a beautiful violet vapour (Fig. 236). Examine the light of a candle which has passed through the vapour; the spectroscope shows you a remarkable spectrum.

CHEMICAL ACTION OF LIGHT ON COMPOUNDS OF SILVER.

Light has a peculiar effect upon silver compounds, turning their colour in a very short time. If, for example, you make some chloride of silver, by adding a solution of common salt to a solution of nitrate of silver, you will find that the chloride, which appears white upon being first made, becomes, in the course of a day or two, of a purplish tint. The iodide of silver is similarly acted upon, and these facts are utilised by the photographer in making his sun-pictures. He places a very thin film of a compound of silver (the iodide) on a glass plate, and then puts this in a camera for the picture to fall on it. The picture, which is thus projected on to the film of silver compound, is formed by rays of every degree of intensity and colour, so that the silver compound is acted upon in a manner which differs for nearly every point of its surface. After an extremely short exposure, the plate is taken into a dark room, lit up only by the light coming through yellow glass; but nothing can be seen on the glass plate. The image, if there be one, is hidden or latent, and it must be "developed," or brought out. A mixture of copperas and acetic acid, in distilled water, is poured over the silver compound, and now a picture begins to show itself. The image is then well washed and "fixed," that is, so dealt with that it is invulnerable to the further assaults of light. To this end it is washed in a solution of cyanide of potassium.

Now, suppose the photographer had taken your likeness and brought it to you at this stage, you would probably be surprised to find yourself appearing on the glass plate like a grey-headed negro, so far as colour goes, because, on the plate, your skin seems dark and your black hair white; in fact, things seem just the contrary from what they are, and the image is therefore called a *negative*. A picture representing you as you are is termed a "positive," and the operation of getting a positive from a negative is known as "printing;" and here again the action of light on a silver compound is made use of, something in this way: A sheet of paper, with chloride of silver in it, is placed in a frame, and the negative is fastened over it, just as you fasten a plate of ground glass and a drawing you are about to copy. Now, upon exposing this to the light of the sun, the chloride of silver in the paper will be acted on wherever it is exposed, and unacted on where it is not exposed; and thus the blacks on the negatives are made into whites on the paper, and so on. This positive picture on the paper has to be fixed, or protected from the further action of the light; that is, any chloride of silver, which might still be further coloured by the action of light, so as to mar the picture, must be now removed; and this is done by dissolving it away with a solution of hyposulphite of soda.

IN THE PHOTOGRAPHER'S STUDIO.

We shall suppose that you have the privilege of walking about the photographer's workshop, of watching him in all his operations, and listening to his explanations. You will now understand his remarks about negatives, positives, printing, fixing, and so on as you stand in his operation-room. He takes a photograph while you are there, and you innocently ask him whether you could not manage to take a photograph with your *camera obscura*. He smiles, and says "No"; for while his own camera (Fig. 237) is essentially the same in principle as yours, it throws a practically perfect image on to the screen at G. In the tube

at A B there are a couple of lenses instead of one, as in your camera, and each of these is of a compound nature, to get rid of the colour defect we mentioned before (p. 445). You will, therefore, understand that the photographer's camera is rather a dear piece of apparatus.

While he is making these observations he points the lens at B towards the object, and while looking at the ground glass screen at G, he turns the screw (V) until the picture cast upon the screen seems, in his eyes, perfect. The cap is now placed over the lens at A, the ground glass is withdrawn, and a dark wooden frame containing the sensitive plate is put in its place. The cap is now removed from the lens, and the borrowed light coming from the object imprints itself into the film of iodide of silver on the plate in a few moments, and now the cap is replaced. Let us inquire into the history of this sensitive plate before it is placed in the camera and after it is taken out. It was first a plate of glass without anything on it save dirt; this the photo-

Fig. 237.—THE CAMERA.

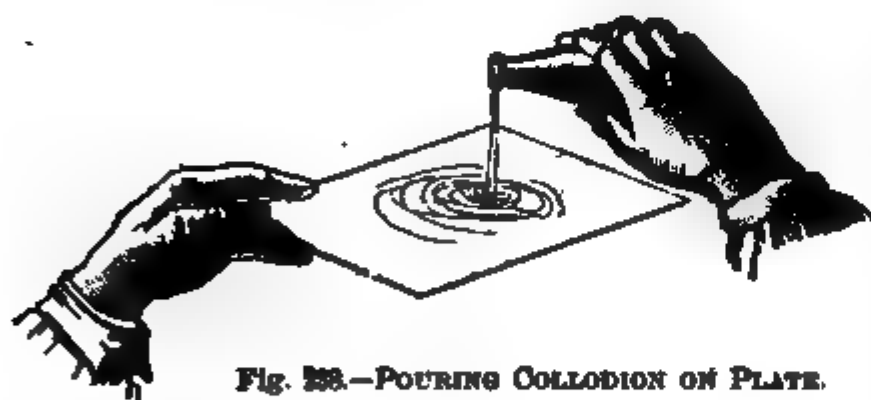


Fig. 238.—POURING COLLODION ON PLATE.

grapher got rid of by scrupulous cleaning; and now it had to go through the operation of having a thin even film of iodide of silver placed on one side. A substance called "iodized collodion" was first poured carefully on to its surface (Fig. 238), and then poured off carefully at one corner, so

that a very thin, even film was left on the surface of the plate. This collodion is a solution of gun-cotton in ether and alcohol, and the iodized collodion is the solution with iodide of potassium added. You will, therefore, understand that the plate was now coated with the iodide of potassium, and upon dipping it into a bath of nitrate of silver the film became impregnated with the sensitive iodide of silver, and was

Fig. 239.—PRINTING FRAMES.

then placed in the dark frame preparatory to taking to the camera to replace G. And now for the history of the plate after exposure. The photographer carefully carries it back in the dark frame to a small room lit up only by red or yellow light, and there a developing solution is poured over it. There are a great many of these developing solutions, the solution of copperas in distilled water and acetic acid being one of them. The image on the plate now comes out, and is washed and then fixed by placing in a dish containing a solution of cyanide of potassium; it is now coated with a very thin covering of copal varnish, and when dry is ready for the operation of printing (Fig. 239). The future history of the negative plate is, therefore, now one of repeated use for obtaining positives. It is placed in a frame with the film side in close contact with paper which has been impregnated with chloride of silver, while the other side of the glass is freely exposed to the light. The daylight passes through the glass negative to the sensitive paper, where the pattern is reversed, and everything appears natural; and now the last operation is to take the paper and place it, picture-side downwards, on the surface of a solution of hyposulphite of soda, which dissolves the unused chloride of silver. The picture is then mounted.

ACIDS AKIN TO HYDROCHLORIC ACID.

This family of elements we have just spoken of is not complete until we have added fluorine, a substance about which not much is known. It appears to have the strongest objection to that freedom which one may easily obtain for chlorine, bromine, and iodine, and we therefore know little of it except as it exists in compounds, and these compounds in their chemical behaviour are remarkably like the corresponding ones of chlorine, bromine, and iodine. This fact we may follow out with profit in the case of one of them.

If you want to obtain hydrochloric acid gas, you place some common salt (chloride of sodium), and strong sulphuric acid into a flask together. The delivery tube extends from the flask to the bottom of a jar, because you have to catch the gas by displacement. If you attempted to catch it over water it would dissolve while rising to the surface, and you would then get a solution of hydrochloric acid, known in commerce as *spirits of salts*. The acids hydrobromic and hydriodic may be prepared in analogous ways, and in the same way you may prepare hydrofluoric acid.

HOW TO WRITE YOUR NAME UPON GLASS.

This hydrofluoric acid has the peculiar property of attacking glass, so that you may readily write your name or anything else on glass in indestructible characters by means of it. To prepare the acid you powder some fluorspar (fluoride of calcium), and place it in a little leaden saucer. Such a saucer you may easily beat out from a small piece of sheet lead, and now you add to the powdered fluorspar some strong sulphuric acid. You next take the plate of glass on which you are going to write, and cover it with a thin coating of beeswax. With the point of a needle you may now write on it whatever you wish, and then place the glass over the leaden vessel with its waxed face downwards. The leaden vessel with fluorspar and sulphuric acid in it is now gently heated, care being taken not to raise the temperature sufficiently to melt the wax. In a few minutes you may remove the glass from the saucer. Hold it now near the fire, and wipe off the wax with a cloth. Whatever you wrote will be seen now graved in the glass. When the mixture in the saucer was heated, hydrofluoric acid was given off, and attacked the glass wherever the point of the needle had left it exposed, while the rest of its surface was protected by the thin coating of wax.

A SUBSTANCE WHICH CHANGES COLOUR WITH HEAT AND REGAINS IT
WITH COLD: REMARKABLE COLOUR-CHANGING BODIES.

If you prepare a fresh solution of starch and add a bit of iodine, the solution becomes of a fine blue colour from the production of iodide of starch. Upon taking some of this blue solution in a test tube and heating it, you will find that before long the colour has vanished, and the queer thing about it is that this blue colour returns as soon as the solution cools. This change of colouring in bodies under the influence of heat is one that chemists are very well acquainted with, for they regularly meet with it in their investigations of coloured substances. We have seen, for example (p. 526), that the oxide of mercury changes colour from red to blackish red, and upon allowing the oxide to cool we should find that it regains its usual colour. But one of the most remarkable colour-changing bodies is another compound of iodine, viz., the iodide of mercury. This is the way you make it: Dissolve some corrosive sublimate (mercuric chloride) in water, and then add to it a solution of iodide of potassium. A brilliant scarlet substance is formed, which is the iodide of mercury. Now, in making the iodide of mercury you must be careful not to add too much iodide of potassium, otherwise the scarlet iodide will be dissolved. Filter. The iodide of mercury left on the paper may be dried on it, and when dry you will find that the scarlet colour will change to yellow upon exposing it to a high temperature, say at a distance over a lamp. And now if you touch the yellow with a pin point it commences to regain its scarlet colour, and wherever you draw the pin a red track is left on the yellow iodide.

COMPOUNDS OF NITROGEN.

All this time we have been keeping in the background one element which we have had occasion to speak of, viz., nitrogen. So far as it alone is concerned it is an unobtrusive element, but it exists in such quantity on the face of the earth, forming fully four-fifths of our atmosphere, that we cannot afford to ignore it, and more especially so when we find that it is a sleeping partner in a vast number of compounds which are of the greatest importance. Ammonia is one of these. Spirits of hartshorn is a solution of ammonia in water: therefore, if you procure some spirits of hartshorn from the druggist you will possess some ammonia ready to hand.

The first thing you notice about ammonia is its very pungent smell, for as soon as ever you take the cork or ground stopper out of the bottle containing it, you are nearly knocked down by the pungent vapour which issues from the bottle. As we have already seen, it is an alkali, so that if you bring a piece of moist reddened litmus paper over the mouth of the bottle it is turned blue directly. There is likewise another colour-test which it will be as well to describe. You take some turmeric root, which is a yellow dye, and heat one part of it with six parts of alcohol. Now you filter, and soak strips of blotting paper in the yellow extract. The dried papers will exhibit a fine yellow tint, and when an alkali comes in contact with them they change to brown. So that now, if you bring a strip of wet turmeric paper near the neck of the ammonia bottle it will turn brown directly.

We have seen that oxide of mercury is decomposed by heating it strongly, so in like manner if ammonia gas be passed through a red-hot tube it is decomposed into its elements, and those elements are found to be nitrogen and hydrogen. The same fact is likewise proved by taking the hydrogen out of it separately, and then the nitrogen; but ammonia cannot be formed by direct combination of nitrogen and hydrogen, because these elements attack each other too feebly, and can only be persuaded to unite by indirect means.

AMMONIA MAY BE PROCURED FROM CHEESE.

If you place a few bits of cheese in a test tube, and heat along with them some solid hydrate of potassium, ammonia will be given off, which you may recognise by its smell, and by its turning turneric paper brown. This is an important experiment, as it shows us that cheese is a compound of nitrogen, for there is no nitrogen in the hydrate of potassium, and it can, therefore, only come from the cheese. In this same simple manner you may prove that nitrogen is contained in a great many more substances, such as horn, nail parings, &c.

UNION OF AMMONIA WITH ACIDS.

Ammonia will neutralise the strongest acid, and form, in this way, a compound differing in its nature entirely, both from the ammonia and the acid used. An exceedingly simple example of this may be observed without apparatus. Uncork the bottle containing ammonia, and bring over its mouth a glass rod which has been dipped in the bottle containing hydrochloric acid. White fumes begin at once to rise from the rod, and they result from the union of the gas ammonia with hydrochloric acid gas. The white compound formed is chloride of ammonia.

AQUAFORTIS, OR NITRIC ACID.

Another important compound of nitrogen is aquafortis, or nitric acid. It is cheap; but, in the study of chemistry, one has to make all sorts of things to get an insight into the action of one substance on another. If you wish, therefore, to make some nitric acid, you will have to proceed as follows: Some nitre (nitrate of potash) is placed in a retort, and strong sulphuric acid is added to it. The retort being now fixed in a stand, its open end is placed in a flask, which is kept cool by either placing a wet cloth over it, or allowing a slow stream of water to fall on it from a tap. The retort is now heated slowly, and the sulphuric acid acts upon the nitre so as to produce nitric acid, which distils over and condenses in the flask. You will not obtain much acid in this way, but sufficient for you to study some of its qualities. It appears of a golden yellow colour, and it is so corrosive that, if you happen to get any on your skin, it will first turn it yellow, and it will afterwards peel off.

GUN-COTTON.

Perhaps the most interesting nitrogen compound to soldiers is that commonly known as gun-cotton, for although it cannot be employed in small arms it is so terribly explosive that it is a most important substance in military mining. It is now manufactured by

Fig. 240.—EFFECT PRODUCED BY EXPLODING GUN COTTON.

our war authorities in a compressed form, and you will gain some idea of the force with which it explodes by looking at the accompanying diagram (Fig. 240), which is a picture of a plate of iron with a slab of gun-cotton on it (A), and the same plate perforated after the explosion (B).

You may experiment in making gun-cotton in a harmless sort of way as follows:—Very clean and dry cotton, that used as lamp-wick, for example, is immersed in a mixture of *strong* sulphuric acid, and *strong* nitric acid, and steeped there for a couple of days. The cotton is then taken out and washed in fresh water until there is no trace of free acid present. After being thoroughly dried it will now go off if you apply a light to it.

The cotton before the steeping process has no nitrogen in it, for it is of the same nature as wood, and contains only carbon, hydrogen, and oxygen, but during the change some of the hydrogen is removed, and its place taken by an oxide of nitrogen.

RED FUMES PRODUCED BY THE UNION OF TWO COLOURLESS GASES.

When you put a scrap of copper into dilute nitric acid red fumes begin to rise from the surface of the liquid. To learn exactly how these fumes are produced, take the apparatus you employed for making hydrogen and place in it copper filings, a little water, and add nitric acid cautiously by the funnel. Place the delivery tube under an inverted jar full of water as usual. The jar will soon be half full of a transparent colourless gas called nitric oxide; and now upon tilting the jar a little on one side bubbles of air may be admitted, and each time a bubble rises to the surface red fumes are produced. The nitric oxide unites with the oxygen in the air to form another oxide of nitrogen, known as nitric peroxide. Hence, when scraps of copper are placed in dilute nitric acid the red fumes which rise from the surface are fumes of nitric peroxide, formed as soon as ever the minute bubbles of nitric oxide produced on the surface of the copper come into contact with the oxygen in the air.

We have used the phrases "*strong*" and "*dilute acid*" in the preceding paragraphs. By the former is meant an acid to which no water has been added, and by the latter an acid which has been mixed with water.

CARBON.

We may now turn our attention to a few of the solid elements. Carbon is one of these, and perhaps the most common on the face of the earth. In an impure form you see it in charcoal, and in the pure form it is one of the most precious stones, for there are probably no more costly natural objects than diamonds; they are, however, carbon pure and crystallised, and just as you burnt charcoal in oxygen to produce carbonic acid, so might you also burn a diamond with the same result. Of course such an experiment is rather expensive; but it is done every year at a to speak of carbon.

case is an exceedingly small one, and, moreover, not a gem of the very first water. It would be a dear performance indeed if a stone were used similar to the famous Koh-i-noor (Fig. 241). These precious stones are found in various parts of the world, in India, Borneo, Brazil, and you must have heard of the diamond-fields of South Africa, which of late years have attracted such vast numbers of restless spirits, just as the gold-fields of California and Australia had before attracted men who were eager to get rich at a single bound.

In combination carbon exists in such a vast number of bodies that you can scarcely turn your eyes anywhere without seeing substances that have the element in them; the materials of our clothes, for example, wool, cotton, silk, furs, and leather, all contain carbon, and the most important element in the vast body of animal and vegetable substances is carbon. Suppose, then, we take a vegetable substance, and see for ourselves what it contains. We shall be performing a simple analysis, and we shall further see that its most important constituent is carbon.

HOW TO ASCERTAIN WHAT STARCH IS MADE OF.

The substance we shall choose, then, will be starch. Let it be as dry as ever you can get it, and then prepare a bulb tube (p. 530) of this shape (Fig. 242).

Before the bend is made in the tube let the bulb be filled with starch. Now heat the bulb in a strong flame like that of a Bunsen burner. The starch will be destroyed, but evidently whatever it is made of will either come out of the tube or remain in the bulb. To catch the former constituents, bring a small test tube (a) over its end as in the diagram. A liquid condenses in the tube, and it has evidently been formed from the destruction of the starch. It is clear, transparent, and not unlike water, and our suspicion that it may be water is confirmed upon adding a bit of the metal potassium, which immediately causes a flame (p. 536). A black deposit remains behind in the bulb (b), which is carbon.

Fig. 242.—ANALYSING STARCH.

We therefore see, as the result of this analysis, that starch is a carbon compound, and that it contains, besides carbon, the elements of water, viz., hydrogen and oxygen.

You may also prove, in a different way, that sugar consists of carbon, hydrogen, and oxygen. Among the various bodies the chemist has to deal with there are some that, if one might so describe it, are extremely thirsty, and they will drink water vapour from the air until they are full of it. Such a substance is sulphuric acid. Take a lump of sugar, and pour over it some strong sulphuric acid. The white of the sugar is soon changed to black, and it is sugar no longer, but simply carbon. The sulphuric acid, in its extreme thirst, has robbed the sugar of all the water it possessed, but in doing so it has destroyed the sugar, and left carbon only. From this we may infer that sugar consists of carbon and water, or of carbon, hydrogen, and oxygen, like starch. But starch and sugar are unlike in having these elements in them in different proportions.

ORGANIC SUBSTANCES.

The chemist has to deal with such a variety of substances, that if he did not classify them he would probably lose a great deal of time and patience too.

Hence, besides dividing all substances into elements, compounds, or mixtures of them, he early found it necessary to divide his vast array of facts into two large classes: one comprising all he knew about elements and compounds found in the dead portion of nature, and the other comprising what is known about compounds formed in the bodies of plants and animals, which, although dead compounds, are the result of vital processes. Hence arose two branches of chemistry, inorganic and organic. The former branch deals with substances like the metals, air, water, and stones; while the latter takes into consideration milk, sugar, tea, starch, and such like things, which are the result of animal or vegetable vital processes. These latter compounds are known as organic substances. It is a peculiar fact that the chief of these substances consist of the four elements carbon, hydrogen, oxygen, and nitrogen. The presence of the first three has been shown just now in starch, and we likewise found nitrogen in cheese, which is an organic substance. You may show the presence of nitrogen in a goose-quill, in the same way, by cutting it up into bits and heating in a test tube, with solid hydrate of potassium again, when ammonia will be given off, which may be tested as before. In these organic substances, however, carbon is always present, whatever other element may be absent, so that organic chemistry is sometimes defined to be "the chemistry of carbon-compounds."

DESTRUCTIVE DISTILLATION.

When we heated the starch in the bulb tube so fiercely, it was destroyed, and water came over into the test tube, which we used as a condenser. Such an operation is called a *dry or destructive distillation*. But the products of dry distillation are not always so simple, for, sometimes, most complex compounds come over from the retort—gases as well as liquids—and these gases are, in some cases, combustible, and may give out light sufficient for illuminating purposes. The manufacture of "gas," at the gas-works attached to nearly every town in the United Kingdom, is a process of dry or destructive distillation. In this operation, as you are aware, coal is put into iron retorts, and heated to a very high temperature. Ammonia, water vapour, volatile oils, and several gases are given off, which have to be severally dealt with in the process of making coal-gas. Some of the substances are taken up by water, other objectionable gases are got rid of by special processes, and the final product passes forward to the large gasometers.

HOW TO MAKE COAL GAS.

Powder some coal and fill a pipe with it, just as you see a smoker charge it with tobacco (Fig. 243). A few bits of coke had better be placed in the bottom of the bowl of the pipe before charging, so as to prevent it from being choked. A clay cap is now fitted over the pipe mouth, and allowed to dry. You may now insert the pipe-bowl, with its contents, into the fire. It will be exactly in the position of an iron retort at the gas-works; and, before long, gas will issue from the end of the stem outside the fire. If you apply a light to the issuing gas, it burns brightly.

Fig. 243.—MAKING COAL GAS.

It was by experiments like this that coal gas was first made, so that you see all the extensive plant now employed has been the outcome of very much thought spread over a long period of time. It was in 1739 that the Rev. Dr. John Clayton,

Dean of Kildare, communicated the result of some of his experiments concerning the making of coal gas to the Royal Society. He was in the habit of collecting the gas in bladders and lighting it at a pinhole, pricked in the side, and then, by gentle pressure, keeping up the flame until the gas was exhausted; and thus he amused his friends. Even so, in this nineteenth century, you may see an experiment, and, like the Dean of Kildare's friends, be simply amused with it. That very experiment may hereafter receive most important applications; and, if you looked upon it with prophetic eye, you would probably regard it as the beginning of some most important future industry.

MARSH GAS.

Now, coal-gas, as we burn it, is not a pure chemical substance, but a mixture of a great many gases; and one of the most abundant of these is marsh gas, also known as fire-damp or light carburetted hydrogen. The first name has reference to its natural production, for it is generated in marshy districts by the decomposition of woody matter. At the bottom of ponds, where vegetable matter collects, and there is, comparatively, no access of air, this gas is produced; and, when the pond is stirred up, it rises to the surface in bubbles. We have abundant evidence to show that coal was once woody matter; and, for ages, it has been undergoing changes similar to that of peat and vegetable matter at the bottom of ponds. Hence, one of the most abundant products of the change is this marsh gas, which may be pent up in coal cavities at an enormous pressure. If a miner happens to strike his pick into such a cavity, the gas issues in a stream from the aperture or "blower," and, mixing with the air of the mine, forms a most explosive mixture - whence the name of "fire-damp."

To make marsh gas, you take 40 parts of crystallised acetate of soda, 40 parts of solid sodio hydrate, and 60 parts of powdered quicklime. This mixture is placed in a flask with delivery tube attached; and, if it now be heated strongly, marsh gas comes off, and may be collected over water, as we have before described. It is a colourless and transparent gas, composed of nothing but carbon and hydrogen. Take the jar of gas you have collected, and, while with one hand you carefully remove the cover, with the other bring down into it the wire with cup (p. 528), into which a bit of greased tow has been put and set on fire. As the ignited tow rapidly descends, it fires the marsh gas at the mouth of the jar; and it continues to burn here with a yellowish flame, but only a poor light, while the tow below goes out, showing that marsh gas alone will not support combustion, and that it burns in contact with air (Fig. 244).

THE OTHER SUBSTANCES IN COAL GAS.

Besides marsh gas, there is hydrogen, nitrogen, olefant gas, and several other bodies in coal gas. The olefant gas is the most valuable, because it contributes so largely to producing the brilliancy of light we value in properly made coal gas. It is a compound of carbon and hydrogen, like marsh gas, only it has much more carbon in it than marsh gas has.

Fig. 244.—
BURNING
MARSH
GAS.

FLAME.

A single glance at a candle flame shows you that it is cone-shaped, with a black-looking wick sticking up some distance towards the middle of it. As you gaze at the flame, you see that the lower part (1, Fig. 245) appears distinctly blue, while there appears above this a sort of dark cone (2) surrounding the wick, and

the rest of the flame (3) is brightly luminous. This is what you see in a burning tallow candle. Now try the following experiment. Clip the wick short; and, after the flame has become steady, bring a sheet of writing paper flat on to it, and allow it to remain so for a second or two. The paper will be burned in a peculiar way and smoked. Turn it over on to the unsmoked side, and you will see clearly that the paper is burnt in a ring, and within this ring there is an unburnt circle. Now, this plainly shows you that the dark internal cone (2), which is opposed to the paper, when the latter is in the position *a b*, has not the power to burn, and

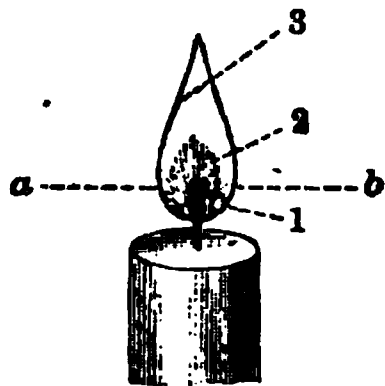


Fig. 245. — CANDLE FLAME.

must, therefore, be at a very much lower temperature than the top portion (3), where the paper is burnt into holes very soon.

The tallow of which the candle is formed is an organic solid, which, by the heat of the burning wick, is melted into a liquid; and, as the heat falling on the top of the tallow cylinder is not so intense towards the edges as in the immediate neighbourhood of the base of the wick, a tallow cup is formed,

which holds the melted tallow. The wick being formed of close parallel fibres of cotton, very minute, hair-like tubes are produced by their being closely packed together; and these capillary tubes (from the Latin *capillus*, hair) draw up the tallow from the foot to the top of the wick, and the liquid is there converted into vapour (Fig. 246). If you blow out a candle, this vapour, no longer having an envelope of flame, escapes, and you not only see it, but smell it, it has such an offensive odour. It is combustible, and this you may easily prove to your satisfaction by blowing out a candle and holding a lighted match in the track of the

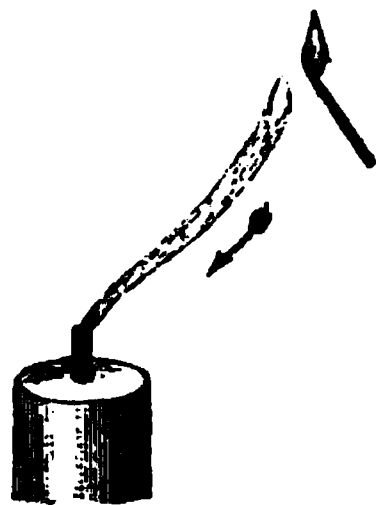


Fig. 246. — TRAVELING FLAME.

ascending vapour. The vapour ignites, and flame travels through the air for a couple of inches and sets the wick on fire once more. The dark cone (2) is, therefore, a cone of vapour, which has so low a temperature that it cannot burn the paper. You might, in the same way, show the hollowness of the Bunsen flame, by bringing down a sheet of paper on to it, when you would form a ring of burnt paper, and, within it, a circle of unburnt (Fig. 247). In the candle flame, outside the cone (2), an intense war of atoms is taking place. Within, we have the tallow vapour molecules in battle array; and, without, we have a constant stream of mixed oxygen and nitrogen atoms rushing upon them. Out of the battle,

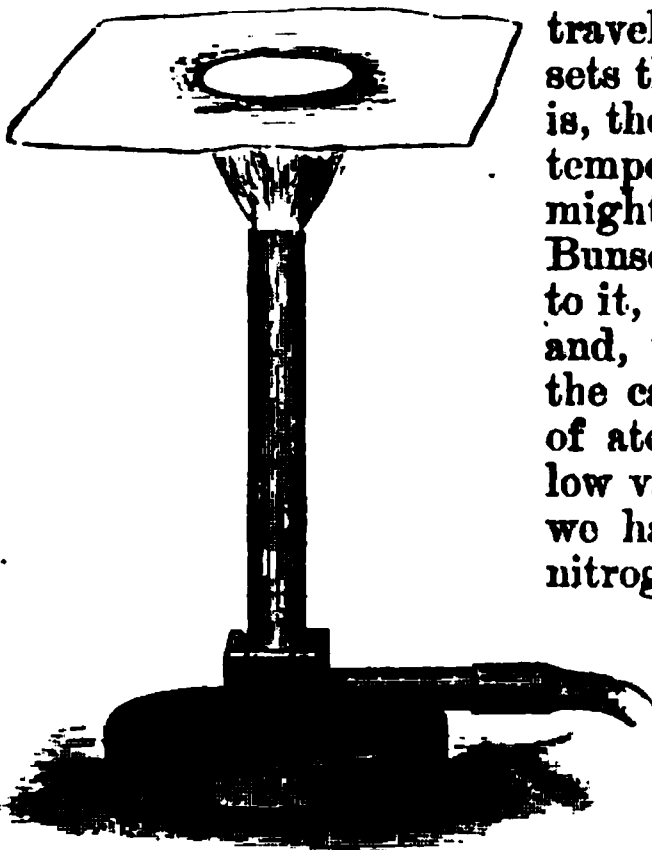


Fig. 247. — SHOWING THE HOLLOWNESS OF FLAME.

perhaps, none come unscathed, save the nitrogen molecules; and the oxygen fights so intensely, and with such a will, that it is constantly rushing away by the tip of the flame, carrying captive carbon (carbonic acid) and hydrogen (water). And from all this rush, commotion, and fighting there arises a great disturbance of the sea of ether surrounding the atoms, producing light (p. 427); just as in a real fight the firing of cannon and guns produces a commotion in the sea of air, which is heard afar off as the roar of cannon or the rattle of musketry.

BRIMSTONE.

Brimstone, or sulphur, is a solid element of some interest, as much for its own qualities as for some of the remarkable compounds it forms with other bodies. If you take up a piece of sulphur, you will observe that it is a brittle solid, for you break small bits off it with your fingers. If you put a bit of it in a test tube and heat it over the spirit lamp, you will see that it soon melts, turning to a thin amber-coloured liquid; and you may readily pour it now from the flask into cold water, when it will remain for some time a stringy, flexible material. But if, instead of pouring it into water, you continue elevating its temperature, you will find that it deepens in colour under the influence of heat, and begins to thicken, so that, by the time you have heated it to between 220° and 250° , you may turn the test tube upside down and it will not fall out. And now, as you go on heating it more and more, it begins to grow thin and liquid again, until, at 400° , it boils; and, if we were to condense the vapour, we should obtain flowers of sulphur on a small scale.

GUNPOWDER.

Sulphur is one of the components of this very important mixture, the others being nitre and charcoal. In one hundred parts of English gunpowder, there are ten of sulphur, fifteen of charcoal, and seventy-five of nitre (nitrate of potash), well mixed. The "blow-up" which occurs when you apply a light to the mixture is the result of certain chemical changes. The sulphur combines with the potassium of the nitre to form sulphide of potash, and the other components of the nitre, viz., oxygen and nitrogen, are thus disposed of: The nitrogen is liberated, and, as usual, moves off without forming any acquaintance; while the oxygen, on the other hand, combines with the charcoal to form carbonic acid, and another gas less rich in oxygen, which is known as carbonic oxide. It will thus be seen that, as soon as ever a light is applied to the gunpowder, a solid mixture becomes a gaseous mixture, and this gaseous mixture is further increased in bulk by the sudden rise of temperature; and it is to this sudden change of volume that powder owes its character for explosive violence.

SULPHUR COMPOUNDS.

We have seen (p. 528) that, when sulphur burns in oxygen, a compound is formed by the union of these two elements. Sulphur also forms other compounds known as sulphides, which are of extreme interest to the chemist, because of their use in his chemical operations, and because

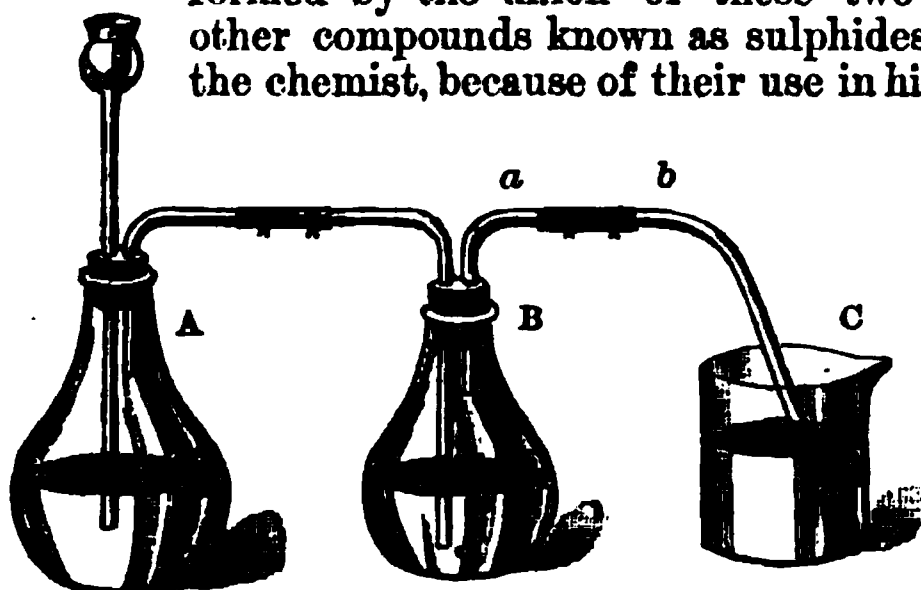


Fig. 248.—SULPHURETTED HYDROGEN APPARATUS.

of their wide distribution in nature. One of these, known as sulphuretted hydrogen, is a transparent colourless gas, smelling like rotten eggs. It occurs naturally in many mineral waters, to which it imparts their peculiar odour and medicinal properties.

To make it, you proceed as follows (Fig. 248): Two flasks, A and B, are fitted up as in the diagram, A having a funnel tube passing through its cork, and also a delivery tube, bent at right angles. B has a similar delivery tube (a), and also a long piece dipping nearly to the bottom of the vessel. The delivery tube of A and the long tube of B are connected (p. 531). Broken bits of sulphide of iron are now

placed in A, and dilute sulphuric acid is poured over it. The gas begins at once to come off, and is carried forward into the vessel B, where it is passed through water, which rids it of many of its impurities. Now, if you connect a tube (b) to a, so that the gas may be passed into a beaker (c) containing a solution of a metal, you will find that a coloured substance is formed; and this coloured substance is a sulphide of the metal dissolved. Thus, suppose you take some of the solution of copper, obtained in a former experiment (p. 545), and place it in c, and then dilute it with water, you will find that a black precipitate forms upon passing sulphuretted hydrogen into it, and this black substance is sulphide of copper. You may, in the same way, take an acid solution of many compounds, containing lead, bismuth, cadmium, mercury, tin, and antimony, and you would get precipitates upon placing them in c, and passing the sulphuretted hydrogen through them. Black sulphides would be formed in the case of mercury, lead, and bismuth, the same as you produced in the case of copper; cadmium would produce a yellow sulphide, and the tin sulphide might be yellow or black; the antimony sulphide would be orange. So that you will perceive one could nearly tell what the metal is from the colour of the precipitate. It is partly on this account that the compound of hydrogen and sulphur, sulphuretted hydrogen, is so valuable to the analytical chemist.

THE INSIDE OF AN EGG.

When you break open an egg, you find it filled with organic matter, which forms very nutritious food. There is a yellow portion called the yolk, and a colourless fluid, known to chemists as *albumen*. This albumen is a curious substance, for if you pour it into a test tube, and then heat it with the flame of a spirit lamp gently, its elements would appear to change their positions, for the albumen turns white and solid. This change takes place at about 65° C., hence you will understand that boiling water will readily turn this liquid albumen into the "white" we are accustomed to see in boiled eggs. Now this albumen contains a small quantity of sulphur, which probably exists in the white as a sulphide. Be this as it may, if you eat your egg with a silver spoon, it will probably be blackened, because the black sulphide of silver is formed. This same black sulphide of silver you may produce by placing in c (Fig. 248) a solution of a silver compound, and passing sulphuretted hydrogen through it.

HOW TO TELL WHETHER SULPHURETTED HYDROGEN IS IN COAL GAS.

Now, in the manufacture of coal gas one of the objectionable gases formed at the same time is sulphuretted hydrogen, and this has to be got rid of. This is done by passing the gases over a mixture of sawdust and oxide of iron in one stage of the manufacture. It often happens, however, that the gas is not purified sufficiently, in which case sulphuretted hydrogen might readily be detected by directing a jet of the gas against a test paper prepared as follows:—A solution of sugar of lead is made and strips of blotting paper soaked in the solution, and then dried. When you want to test anything for sulphuretted hydrogen, one of these strips is moistened with water, and taken to where it is supposed to be. If there be any sulphuretted hydrogen present the test paper soon turns black from the formation of the black sulphide of lead.

PHOSPHORUS.

One of our earliest experiments was with phosphorus, where we burnt this element in a confined quantity of air. If you take the remainder of the stick of phosphorus now in your possession you will see that it is a slightly yellow, half-

transparent solid. It melts at so low a temperature as 44° C. It ignites so readily in its desire to combine with the oxygen of the air that it is dangerous to handle it carelessly, and the precautions given on p. 524 ought not to be forgotten. In the air it gives off white fumes, and emits a pale phosphorescent light in the dark. This, of course, you are quite familiar with, for have you not repeatedly rubbed the tip of a match which has phosphorus on it gently on a wall in the dark just on purpose to see the faintly luminous track which has been left? A trace of phosphorus remained on the wall after each stroke, and uniting with the oxygen of the air produced the faint light which pleased you. Now this phosphorus exists in bones, and is made on the large scale from bones. Animals obtain their supply of the element from vegetables, which again, in their turn, get it from the soil.

THE COMPOSITION OF BONES.

Bones consist of organic matter and of inorganic, there being in 100 parts about 32 of the former and 68 of the latter, from which you will see, as one might nearly expect, that bone is very largely composed of inorganic substances. If you calcine the bone the organic portion of it is destroyed, and the inorganic portion remains behind as bone ash. This bone ash consists of various substances, the least important, so far as quantity is concerned, being fluoride of calcium, phosphate of magnesia, oxide of sodium, chloride of sodium, and the oxides of iron and manganese, while the more important are carbonate of lime (chalk) and phosphate of lime. The phosphate of lime is the most important of all. You may regard this phosphate of lime as being a compound formed of the white oxide of phosphorus we obtained a while ago (p. 526) and quicklime, for if you could bring these two oxides to unite the product would be phosphate of lime.

THE COMPOSITION OF PLANTS.

When you take a plant and burn it there is left behind an earthy substance. The commonest example to the point which one can call to mind is the burning of tobacco. For a time as it burns various gases are given off, but at last it ceases to burn and a white ash is left. If you were to burn hay of any kind you would have an ash left in the same way. The woody matter of the plant which disappears consists, like starch, of carbon, hydrogen, and oxygen alone, but the ash consists of a variety of inorganic compounds; for example, in the ash of clover hay there is potash, soda, lime, magnesia, oxide of iron, oxide of phosphorus, chlorine, and silica. The most important constituents seem to be the oxide of phosphorus, magnesia, and lime. Now these compounds are obtained from the soil by means of the roots, and these roots, therefore, play a most important part in imbibing the kinds of substances required by the plant.

THE USE OF MANURES.

Year after year crops are cut and taken away—in other words, every year certain substances are taken away from the soil of a field to such an extent that after a number of years it has been drained of them, and therefore cannot support the same kinds of grass or wheat any more. The farmer, therefore, puts manure on to his land to replace the substances that have been taken out of it. If he be a scientific farmer he supplies his lands with different kinds of manure with discrimination. Thus, if he wanted to grow a good crop of clover, he would not fail to give it a fair quantity of lime, supposing it was deficient in this substance, because nearly half the ash of this clover consists of lime; and when he thought it necessary to return the oxide of phosphorus which his crops had taken away

he would apply bone-dust, or some other manure of this kind. Agricultural chemistry deals with such matters as these.

THE CHEMIST'S SHORTHAND.

You know that it takes boys a long time to become accustomed to writing to such an extent that they may take a pleasure in it, and they therefore very often neglect letter writing when they ought really not to do so. As they grow older and become men, business increases on their hands, and the amount of writing they have to get through is sometimes very great indeed. The ordinary method is slow and wearisome, and often, when tired out, has the man of business exclaimed, Why have we no way of writing which equals speech in ease and swiftness? Maybe he goes to some political meeting, and sees a number of men writing down, by means of shorthand, the speeches as fast as they are spoken. He now feels that this is the sort of thing he has so long required. The shorthand of the literary and business man is, therefore, of very great use, and the chemist has a shorthand, too, which he finds equally useful. In the first place, he has a symbol for each of the elements, which may easily be remembered, because it is the first letter of its name, thus, P stands for phosphorus, and O for oxygen. The following is a list of some of the more common elements, with their symbols:—

Aluminium, Al.	27.4	Fluorine, F.	19	Phosphorus, P.	31
Antimony, Sb.	122	Gold, Au.	197	Platinum, Pt.	197.5
Arsenic, As.	75	Hydrogen, H.	1	Potassium, K.	39.1
Barium, Ba.	137	Iodine, I.	127	Selenium, Se.	79.5
Bismuth, Bi.	210	Iron, Fe.	56	Silver, Ag.	108
Boron, B.	11	Lead, Pb.	207	Silicon, Si.	28
Bromine, Br.	80	Magnesium, Mg.	24	Sodium, Na.	23
Calcium, Ca.	40	Manganese, Mn.	55	Strontium, Sr.	87.5
Carbon, C.	12	Mercury, Hg.	200	Sulphur, S.	32
Chlorine, Cl.	35.5	Nickel, Ni.	58.7	Tellurium, Te.	129
Chromium, Cr.	52.2	Nitrogen, N.	14	Tin, Sn.	118
Cobalt, Co.	58.7	Oxygen, O.	16	Zinc, Zn.	65.2
Copper, Cu.	63.5				

The meaning attached to the numbers will be explained farther on. Where the symbol appears to have nothing to do with the English name it arises from its being part of the Latin name, as you will see from this short list:—

English.	Latin.	English.	Latin.
Antimony	<i>Stibium</i>	Potassium	<i>Kalium</i>
Gold	<i>Aurum</i>	Silver	<i>Argentum</i>
Iron	<i>Ferrum</i>	Sodium	<i>Natrium</i>
Lead	<i>Plumbum</i>	Tin	<i>Stannum</i>
	<i>Greek.</i>		
Mercury	<i>Hydrargyrum</i>		

ATOMS.

But each of these symbols has a deeper significance, and one which we shall now try and explain. If you take a piece of sulphur and break it into small bits, you can see one of the smallest of them with the naked eye. Pick this smallest bit out and crush it into a thousand pieces. It is probable that now you cannot see one of these minute particles, and you only see the whole lot together, in the form of a powder. But if you bring a microscope to bear, you will now be able to distinguish the smallest particle among all these very small particles. You cannot carry the subdivision on any farther by any means in your power, so that now you must try and carry it on in imagination. Divide this particle, re-divide it, and subdivide it, carrying on the operation in your mind. It is supposed that, at last, a particle will be obtained which is incapable of further subdivision, is

uncutable, or, to put it in scientific language, is *atomic*. No doubt, your imagination has failed you in forming a picture of an *atom* (Gr., *a*, not; and *temno*, I cut), as such an uncuttable particle of sulphur would be called; and the chemist contents himself by saying that *an atom is the least part of an elementary body which can enter into a compound or be expelled from it*. We will return to this definition again after a while.

Chemists have supposed a great deal about these atoms, and they have an idea that they are nearly all of the same size; but, as to their forms, they cannot tell anything. They may be in shape like cricket balls, or they may, as some have thought, be all vortex rings (p. 561). But, whatever may be their size, or form, it is agreed to represent an atom of any element by the symbol of that element; thus, P not only means phosphorus, but also an atom of phosphorus; and O means one atom of oxygen, H one atom of hydrogen, and so on. It is sometimes necessary to speak of a number of atoms, and express it in symbols; when this is the case, a small figure is placed below the letter to the right. Two atoms of hydrogen would, in this way, be expressed by H_2 , and three atoms of oxygen by O_3 .

MOLECULES.

A molecule is a cluster of atoms. Thus, two atoms of hydrogen and one of oxygen, when bound together by their mutual attractions, form one molecule of water. A molecule of red precipitate consists of one atom of mercury and one of oxygen. It will thus be seen that a molecule is really the very least part of a compound, just as an atom is the very least part of an elementary substance. And now let us see one or two of the uses the chemist can make of his shorthand. On page 527, we described the decomposing action of heat on red precipitate; that action a chemist would dismiss, in a couple of seconds, in this way:—



This is called an equation, for the number of atoms on one side of the “equals” sign = is the same as the number of atoms on the other; but, while on one side we have a molecule of red precipitate, HgO , we are shown, on the other side, that this molecule has been split up into an atom of mercury and an atom of oxygen. Hence, you see that, in a chemical equation, you have, on the one side, the unaltered substance or substances; and, on the other side, the product or products of the changes they have undergone. To take another example or two: Our experiment regarding the burning of hydrogen would be thus represented in an equation:—



And the action of potassium on the water, in this way:—



This last example is perhaps a little more difficult than the others, but upon regarding it closely it tells us that when an atom of potassium is added to a molecule of water this atom of potassium thrusts out of the water molecule an atom of hydrogen, and takes its place. You thus get formed a substance called hydrate of potassium, KHO , and free hydrogen, H ; and this example will illustrate the definition of an atom given in a preceding paragraph, for K represents the very least part of the element potassium which can enter into the compound OH_2 , while H, on the other side of the equation, also represents the very least part of hydrogen which can be expelled from the water.

FORMULÆ AND EQUATIONS.

You will now have learnt that a molecule of any substance is represented by the arrangement side by side of the symbols of the atoms which form it. Such an arrangement of the symbols is called the formula of the molecule. We have had to speak of a great many substances, and no doubt you will be curious to know what are the formulæ for many of them. A short list is therefore subjoined.

Common Name.	Formula.	Common Name.	Formula.
Carbonic acid (Carbonic anhydride)	CO ₂	Iodide of silver (Argentio iodide)	AgI
Phosphoric anhydride	P ₂ O ₅	Potassic iodide	KI
Sulphurous do.	SO ₂	Mercuric do.	HgI ₂
Manganic oxide	MnO ₂	Hydrofluoric acid	HF
Potash	OK	Fluor spar (Calcic fluoride)	CaF ₂
Soda	ONa	Silicic fluoride	SiF ₄
Sand (silica)	SiO ₂	Lime water (Calcic hydrate)	CaH ₂ O ₂
Water	OH	Potassic hydrate	KHO
Red precipitate (Mercuric oxide)	HgO	Oil of vitriol (Sulphuric acid)	SO ₄ H ₂
Magnesia	MgO	Sulphate of soda	SO ₄ Na ₂
Nitric oxide	N ₂ O	Sulphate of lime	SO ₄ Ca
Nitric peroxide	N ₂ O ₄	Aqua fortis (Nitric acid)	NO ₃ H
Chloric peroxide	Cl ₂ O ₄	Nitrate of copper	N ₂ O ₅ Cu
Spirits of salts (Hydrochloric acid)	HCl	Nitrate of soda	NO ₃ Na
Calcic chloride	CaCl ₂	Chlorate of potash	KClO ₃
Zincic do.	ZnCl ₂	Sulphuretted hydrogen	SH ₂
Common salt (Sodic chloride)	NaCl	Ferrous sulphide	FeS
Ferrous chloride	FeCl ₂	Cupric do.	CuS
Butter of antimony (Antimonious chloride)	SbCl ₃	Carburetted hydrogen	CH ₄
Ammonic chloride	NH ₄ Cl	Ammonia	NH ₃
Corrosive sublimate (Mercuric chloride)	HgCl ₂	Sugar	C ₁₂ H ₂₂ O ₁₁
Hydrobromic acid	HBr	Starch	C ₁₂ H ₂₀ O ₁₀
Hydriodic acid	HI	Bone ash	P ₂ O ₅ Ca ₃

In what little we have said about equations we have not referred to the quantitative aspect in which we may regard them. As, however, this is a matter of the greatest importance, we must at least refer to it, although we cannot in this elementary sketch go into the reasons and experiments which have led chemists to these results. A number is assigned to each element, which is called its atomic weight, and in the short table we have given the atomic weight is seen after each symbol (p. 553). The use of this number will be seen in a consideration of the following question:—How much sodium is there in 10 lb. of common salt? The formula for common salt is NaCl, and upon turning to the table of atomic weights we see that the elements sodium and chlorine have the weights 23 and 35.5 respectively. Now in the molecule of common salt there is one atom of sodium and one atom of chlorine; therefore, the weight of the molecule is 23 + 35.5, which equals 58.5, i.e., in 58.5 parts of common salt there is of sodium 23 parts. A simple proportion sum will therefore give us now the required answer.

$$\begin{array}{ccccccc} \text{Salt.} & \text{Salt.} & \text{Sodium.} & \text{Sodium.} & & & \\ 58.5 & : & 10 & : & 23 & : & x \\ & & & & & & x = \frac{10 \times 23}{58.5} = 3.93 \text{ lbs.} \end{array}$$

This is only one of a host of uses which may be made of these numbers.

MECHANICS.

THE MOVEMENTS OF A CRICKET BALL AND THE LESSONS TO BE DERIVED THEREFROM.

A CRICKET MATCH is about to begin. The captain of the out side has placed his men at the proper points, and now at a sign from one of the umpires a bowler shoots forth a swinging round-arm ball. The ball flies wide of the mark it was intended for, and neither bat, wicket, nor wicket-keeper stops it, and it is ultimately brought to a standstill by long-stop. Now, the ball would have gone a long way if long-stop had not barred its farther progress, because it was sent off with all the force a very muscular young fellow could command; but if long-stop had not been there it would finally have come to rest, and we may as well inquire for a moment what would have put the brake, so to speak, on to the whirling ball. In the first place, then, the air offered a certain resistance to it, so slight, however, that we generally fail to take it into account, except we are considering very light bodies, like feathers, which are very perceptibly retarded in their motion through air; and in the second place there was the very material resistance of the ground, for although the grass was shorn pretty short, each blade of it the ball came in contact with acted like a puny long-stop, to be despised individually, but not to be scorned where there were thousands of them one after the other, for it was principally by their united efforts that the ball was finally brought to rest, thus showing us, in a way, that union is strength. If we remove many of the obstacles which now bar its progress still, the ball will speed along for a greater length of time, and will consequently go a very long way farther, and such would be the case if, for the cricket field, we could substitute a vast billiard table, for now the rubbing of the ball against obstacles on the ground would be lessened, and much more so still would it be lessened if we could have an enormous horizontal surface of smooth ice, for now the ball would have very little friction at all to oppose its progress. We find, therefore, that the more perfect we make the conditions of movement—that is, the more we reduce the resistance offered to the moving ball—the *longer* it continues to move, and the *more uniformly* it continues to go on, so that if we could make the ice so smooth that it offered no resistance at all, and if we could remove the air so that it likewise offered no resistance, the cricket ball, when once hurled from the hand of the bowler, would go on moving for ever, and in a straight line. When the ball lay on the ground, before the cricketer picked it up, it would likewise have remained there for ever if no external force in the shape of the cricketer's hand, or of a blow from a bat, had not set it moving. A consideration of such facts led Newton to declare that *every body, like a cricket ball for example, continues in its state of rest or of uniform motion in a straight line, except in so far as it is compelled by forces to change that state.* This is known as the First Law of Motion.

And now, while we have been seeking scientific information, our players have been warming to the game; several overs have been played, and one important batsman has been caught out. The band strikes up, and the one who has fallen is soon replaced. Before we proceed further in considering the movements of the ball, let us inquire whether there are no means of ascertaining the force with which it arrives at the wicket. We shall find the kind of instrument we want in a place where one would little think of looking for it, and among folk, perchance, without a single scientific idea, and with only one aim—that of pleasure, in short, amidst all the turmoil of a fair. Even in such unlikely places may we find food for much scientific thought.

AT THE FAIR.

You have many a time been to a fair, feast, rush-bearing, or wakes, as these annual gatherings are variously called. As you have entered the grounds you have been assailed by such a jumble of sounds and noises, all mixed up, that you might have been frightened had you not known what they meant. If a person could be dropped down on such a scene blindfolded, it would appear as if he were hearkening to a barrel-organ contest, with a fair sprinkling of German bands, screaming of whistles, rattling of machinery, and above all a persistent chatter, similar to what one hears in the monkey-house at the Zoological Gardens. Every now and again there is heard, besides, the sound of firearms, or a thud indicative of a heavy blow delivered in some way. Suppose, then, we turn around to see the cause of the latter noise. Ere long

we find ourselves in a ring of young fellows, who are trying their strength by taking hold of a heavy wooden mallet, and delivering a swinging blow to a sort of buffer connected with a machine. When the blow is delivered, an iron index rushes up an upright piece of wood some sixteen or seventeen feet high, and stops at a figure which indicates, or is supposed to indicate, the force which has been exerted in pounds. It is instructive to stand here for a few minutes. A delicate young fellow steps up and determines to see how strong he is. He

seizes the mallet, delivers his blow on the buffer, but the iron index only travels half-way up the scale. He makes a few more trials of his strength, but each time he falls short of the preceding result. From which it would appear that a judicious course of gymnastics would not harm him, but be a benefit. There next comes up a youth with springy step, whose every movement denotes strength well husbanded. He takes hold of the mallet, and comes down on the buffer with it, and the index goes swinging up to the top of the scale, and opens a box, out of which a "Jack" looks down approvingly. The appearance of "Jack in the box" is hailed with a round of laughter.

Upon proceeding a little farther we see a modification of this same piece of apparatus (Fig. 249). In this second device you use your fist instead of a mallet, and knock at a padded cushion instead of a wooden buffer. The strength of your blow is, however, determined in the same way, viz., by an index travelling over a scale, circular in this case. As, however, striking with the fist is a much milder sort of thing than striking with a ponderous mallet, the instru-

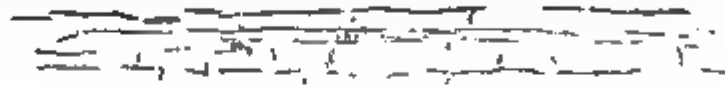


Fig. 249.—TRYING HIS STRENGTH.

ment for fist-blows is more neatly got up, and occupies less space than the other. These measurers of force are generally known by the name of *dynamometers*. What we propose, therefore, to do now, is to bring one of these dynamometers into the field, and place it in the position of the wicket, so that we may see what force the bowlers exert when they hurl away the ball.

WEIGHTS AND MEASUREMENTS OF CRICKET.

The weight of a bat is not regulated, we believe, by any precise rule save the convenience of the batsman, so that we shall call the bat we consider in our calculations 2½ lbs. weight. The ball we may take to be about 5½ oz., or ⅜ of a pound; and the distance of the wickets 22 yards or 66 feet apart. As it is customary in mechanics, all our calculations must be made in feet or pounds; and if we have occasion to take time into consideration, we must reckon it in seconds.

SPEED OF THE BALL.

Now we know the exact speed or velocity of a cannon ball under various circumstances, because in the course of gunnery experiments it has been found necessary to acquire data of this kind, but we are not aware that any one has ever taken the trouble to ascertain the exact speed of a cricket ball. The game of cricket is regarded as pleasure pure and simple; and in considering bowling, we look at the results alone, and call that man the best in this respect who puts out the greatest number of men in the least number of overs, or, what nearly amounts to the same thing, permits batsmen to get only a small score from his balls. Let us now, however, examine the subject to some extent scientifically, and if at any time you are inclined to investigate the matter more thoroughly, you may be sure that a nation of cricketers will be delighted with your results. And now for some rough experiments, and the lessons to be derived therefrom.

Suppose that we have the padded-cushion dynamometer in the place of the three stumps, and that 66 feet away a bowler stands and sends his balls with such precision that he never misses the cushion; we want now to see what will be the indications of the instrument for each variation of speed, and we shall suppose farther, by the way, that we have a means of ascertaining the exact speed or velocity, taking it to be uniform, or of the same rate of speed from leaving the bowler to reaching the dynamometer.

These are our results:—

Distance Travelled by Ball.	Weight of Ball.	Time taken in Travelling from Bowler to Dynamometer.	Speed or Velocity of Ball.	Reading on Dynamometer.
66 feet.	⅜ lbs.	1"	66ft. per second.	22½ lbs.
"	"	½"	88 " "	30
"	"	⅓"	132 " "	45

This little table, then, shows us that the reading of the dynamometer is very much influenced by the speed of the ball, for when the speed was doubled the reading of the dynamometer was also doubled. And in further studying the relation between weight of ball, speed, and dynamometer reading, we see that the last is in every case the product obtained by multiplying together weight and speed. Thus:—

Weight of Ball.	Speed of it.	Force Exerted.
⅜ × 66	=	22.41
⅜ × 88	=	29.92
⅜ × 132	=	41.88

We have gained a very important lesson, then, in learning that the force

exerted by a moving body like a ball is measured by the number obtained when you multiply the average speed in a second of time by the weight of the moving body.

THE JUMPING OF A CANNON.

And now we may turn aside for a moment to consider a phenomenon you have noticed repeatedly, but more especially when you have been celebrating the Gunpowder Plot on the 5th of November. You have, no doubt, observed that the little cannon which you charged with powder, when you let it off jumped backwards a long way. Why?

You know that when you let gunpowder off it explodes with great force, so that the miner and quarry-man use it regularly in blasting rocks. They drill holes into the rocks—an operation which varies somewhat with the nature of the stone—and then, when a hole has been made large and deep enough, it is filled with gunpowder, or some of the more recently invented explosive materials, and made up with sand. The explosive material may now be let off either by electrical or other means, and the rock is rent asunder. You can imagine, then, that after your cannon has been charged with powder, and the mouth afterwards jammed tight with paper, &c., it would burst upon being let off if the iron or brass barrel were not strong enough to withstand bursting. The whole lot of exploded material is, therefore, forced out of the mouth, and if there be a ball in the cannon this force will be utilised in sending it forward with very great speed.

But the expansion of the powder is exerted in every direction, and the cannon is made to jump back with the same force as the ball leaps forward in its progress out of the mouth. If, therefore, we know the weights of the ball and cannon, and the commencing speed of either, we can reckon up the speed of the other. Suppose your cannon weighs 1 lb., and the ball $\frac{1}{11}$ oz., or $\frac{1}{88}$ of a lb., and the cannon jumps back with a commencing speed of 14 feet per second, then—

$$\begin{array}{ccccccc} \text{Speed of} & & \text{Weight} & & & & \text{Weight of} \\ \text{Jumping Cannon.} & & \text{of Cannon.} & & & & \text{Ball.} \\ 14 & \times & 1 & = & \text{Speed of ball} & \times & \frac{1}{88} \end{array}$$

from which you may calculate the beginning speed of the ball if you know how to do simple equations. Thus:—

$$\text{Speed of Ball} = \frac{14 \times 1}{\frac{1}{88}} = 468 \text{ feet per second.}$$

When one substance presses against another it is pressed back again by the other with the same amount of force, only in a contrary direction.

The consideration of such facts as we have given in this paragraph, has led to what is called the Third Law of Motion, which is this:—*To every action there is always an equal and contrary reaction.*

STRIKING A BALL.

To return to our match: one of the men who is now having his innings, swings his bat round through four feet in a quarter of a second, when he is striking at a ball, i.e., he gives his bat a velocity of sweep of 16 feet per second. The bat weighs $2\frac{1}{4}$ lbs., and we may measure the force it exerts by applying the rule we learnt when studying the force exerted by a ball; we thus get $16 \times 2\frac{1}{4} = 36$ lbs. If two people are going along a road at the same speed, one of them a light weight and the other as heavy as Falstaff, you know that if they accidentally bump against each other, the heavier man will scarcely be affected, while the lighter one is sent spinning back for a couple of

feet, which teaches us that the body which exerts most force has its own way. So it is in batting, for the swinging bat, to be effective, must exert more force than the on-rushing ball.* If, therefore, you turn back to our dynamometrical results, you will see that our batsman, exerting his force of 36 lbs., would be all right for the ball with velocity and would probably send it far afield when the ball had a velocity of 13; now it would exert a force of 45 and would vanquish the bat, either sending hands, or else very unpleasantly nunn the ball to be incapable of rebounding.

An apparently very surprising feat (Fig. 250), is sometimes performed by travelling "Samsons." The performer, lying on his back, has an anvil laid on the pit of his stomach, which an accomplice beats with a sledge-hammer, like a smith at full work in his smithy. No evil consequences follow the exhibition. If the iron had been a thin piece, the blows would have killed the performer by the hammer driving the iron before it; but if you strike

Fig. 250. — EXTRAORDINARY FEAT.

an anvil on the side with a hammer in this way, you cannot move it more than a fraction of an inch, and in the same way when you direct it downwards the heavy mass of metal "breaks the force" of the descending hammer, and thus prevents any damaging effect to the person supporting it. In cricket you drive a light ball before you when you strike it, but if the ball were made of lead you would send it only a small way, and probably shiver the bat in the effort; similarly, in the trick we have been speaking of a very light anvil would be sent into the performer's body, but a very heavy one is scarcely stirred.

Besides knocking balls about in the game of cricket, you may also play with air and smoke particles in the most entertaining manner by means of a vortex-box.

HOW TO MAKE A VORTEX-BOX.

Procure a tea-chest. One of its sides will have been knocked off to get out the tea. In the side opposite to the removed one get a carpenter to cut out a circular hole about three inches and a half in diameter; or you may do this yourself, if possessed of tools, by first drawing a correct circle of the required size in the middle of the square side; and then drilling a hole at *a* in one portion of its circumference, and by means of a small saw working from *a* all round until the circular piece of wood is cut out (Fig. 251). In one of the other sides drill a couple of holes about five inches apart for the insertion of corks. The box has now four openings—two small holes (*b* and *c*) for the insertion of corks, one large circular aperture at *a*, and the opening formed by a removed side. Over this last nail a square of canvas. In cutting out the canvas, make it rather bigger than one of the sides of the

Fig. 251. — MAKING A VORTEX BOX.

* We purposely refrain from taking elasticity into account.

box, so that when it is neatly nailed down to replace the removed side, the overlapping portion may be gummed or glued to the four sides of the box it is in contact with. We require now two small glass flasks, four corks, and two pieces of glass tubing. Through the four corks holes must be bored with cork-borers, so that the pieces of glass tubing may be pushed through with facility only when they are wet—in other words, the diameters of the holes bored in the corks must be very slightly less than the width of the tubes, so that the connections may be air-tight. Two of these corks must be inserted into the two small round holes in the box, and the tubing must now be bent so as to connect the two flasks with the interior of the box, as represented in the diagram (Fig. 252).

VORTEX-RINGS.

Fig 252.—THE VORTEX BOX.

Every time the canvas of the box is now smartly tapped with the hand an invisible vortex-ring rushes out of the box. It proceeds nearly in a straight line, so that when one wishes to assume the mysterious for the sake of sport, the front of the vortex-box may be painted to represent a face, with the round hole for a mouth, and the gas-light in the middle of the room may be blown out by this wooden *Æolus* every time the performer wishes (Fig. 252).

To make the size, form, and motion of the rings visible, the box must now be filled with smoke. Place in one of the flasks strong ammonia solution, and in the other a strong solution of hydrochloric acid, or spirits of salts, as it is termed in the trade. If the two flasks be now connected with the tubes, and if the liquids within them be strongly heated, the gases are driven into the inside of the box, and there form a white smoke of ammoniac chloride. The box soon fills with smoke, and sooner still, of course, if the round mouth be closed for a few minutes with a piece of cardboard or tin.

The box is now full. We remove the cardboard from the mouth, and give the canvas a smart knock with the fist. Immediately a beautiful white wreath of smoke is formed at the mouth, and travels along in a straight line, to the delight of all beholders.

WEIGHT.

When you let go of a stone it falls. Why did it not remain in mid-air without falling? We commonly say because the earth pulls at it, and thus, when it is at liberty to move the direction of its movement is earthwards. The earth pulls at everything in this way, only in different degrees; a piece of lead, for example, being pulled with much more power than a piece of cork of the same size, so that if you put the lead in one pan of a pair of scales, and the cork in the other, the lead will fly downwards and make the cork kick the beam. Every material substance on the surface of the earth is pulled towards the earth, and we give expression to the fact when we say that it has *weight*. The weight of solid substances like bats and balls is very apparent, but it is not so easy to see that air has weight; such is the case, however.

TO PROVE THAT THE AIR HAS WEIGHT.

Now this quality of weight which everything has is possessed in very various degrees; so that we have very heavy things, like lead, and very light ones, like feathers, but we have no common thing as light as the air we breathe, so that "as

light as air" is a recognised expression when we want to give the idea of extreme lightness. The air, in fact, is so very light that one has some difficulty in seeing

how to prove that it has weight at all. This, however, is a very simple demonstration of the fact. Squeeze the air out of a pair of bellows, and then close the valve-hole and nozzle. If the covers over the valve-hole and nozzle be air-tight, you will find it now impossible to separate the boards of the bellows, because the weight of the external air which presses on them is so very great—some hundredweights, in fact.

The weight of air may be likewise proved in this way, a method which you will see tried at lectures sometimes. A flask is taken and emptied of air at the air-pump, and when it is as

Fig. 253.—SHOWING THAT THE AIR HAS WEIGHT.

empty as ever it can be got a tap in its neck is turned off, so that when it is taken away from the pump no air can get into it. If the flask be now weighed (Fig. 253), the weights put in the other pan will be the weight of the flask alone, supposing it to be perfectly empty, and now, upon turning the tap, you hear a noise, which arises from the in-rush of air into the empty flask, and you will find that the flask now descends, and the extra weights required to counterpoise or balance it once more give the weight of the air you have admitted.



Fig. 254.—GLASS TURNED UPSIDE-DOWN WITHOUT SPILLING ITS CONTENTS.

PHENOMENA RESULTING FROM PRESSURE OF THE AIR.

There are many things you have done, and perhaps wondered how they could be explained, which depend on this pressure of the atmosphere. In passing, we may here add that fluids like air press equally in every direction, and are thus unlike solids, which press on each other only in one direction. Thus, to make the matter plain, suppose you have a little cube an inch square on each of its six sides. If that cube were suspended in air, the air would press upon each of its six faces with a pressure of about 15 lbs.; but if the cube itself rested on another solid, it would be pressed only at the surface resting on the other solid. The following trick furnishes a proof of the atmosphere's upward pressure. A wine-glass is filled with water to the brim, and now covered with a card. Upon inverting the glass you will find that the card will not fall off, and consequently the water will not escape (Fig. 254). It is held there by the upward pressure of the atmosphere.

The common leather sucker you have so often employed for lifting heavy

Fig. 255.—THE SUCKER.

stones works in virtue of the pressure of the air (Fig. 255). For let us see what happens. After moistening the circular piece of leather, you press it to the wet surface of a flat stone, and when it adheres sufficiently well you pull at the string which is fastened to the centre of it. The leather is now pulled into a bell shape, and in the inside of it there is very little air; it is in a state very much like the flask that was emptied at the air-pump. And what is the condition of such an empty space? The outside air is pressing heavily on the vessel, which encloses it on every side. This is sometimes seen very forcibly when attempting to empty flasks at the air-pump, for if the glass be not thick enough to withstand the outside pressure it will be shivered into a thousand pieces. To return to our sucker. Here we have an empty cavity, surrounded by the bell-shaped leather on one side and by the flat stone on the other; the pressure on the stone from the outside is greater than its weight, so that when you lift the sucker up the stone comes with it.

THE ATMOSPHERE.

It will be seen, then, that the air we breathe has weight, and a word or two as to the extent of the atmosphere will now prove of interest. It is a vast ocean, at the bottom of which we live. Its height has never yet been ascertained, for the highest mountain on the surface of the earth does not reach to the top of it, nor has any balloonist hitherto been so venturesome as to go so high. In fact, no living man could go so high, for it presents this peculiarity: that the higher you go in it the thinner it becomes, so that at a height of seven or eight miles you could not live in it. But

whatever its extent may be—and some suppose it may reach 200 miles high—we can readily tell the weight of a column of it one inch square in section, and extending from the surface of the earth at the sea-level to its farthest reach beyond the clouds. Such a column presses down on a square inch of surface with a certain weight, and that weight is 15 lbs., or thereabouts. If you take a long U tube (A, Fig. 256), and pour into it a small quantity of mercury, and then some water, you will have two liquid columns of very different lengths, for the short heavy column of mercury (a b) will balance a longer column of water (a' b') which has the same weight. So, likewise, in the syphon barometer (B): in the arm a c you have nothing but mercury, for the part b c is an empty space, and the

column of mercury (a b), about thirty inches long, is balanced by a similar column of air reaching from a' to the confines of the atmosphere. Now, if this long column of mercury in B was a square inch in surface or cross-section throughout, then it would weigh about 15 lbs., thus showing, as we

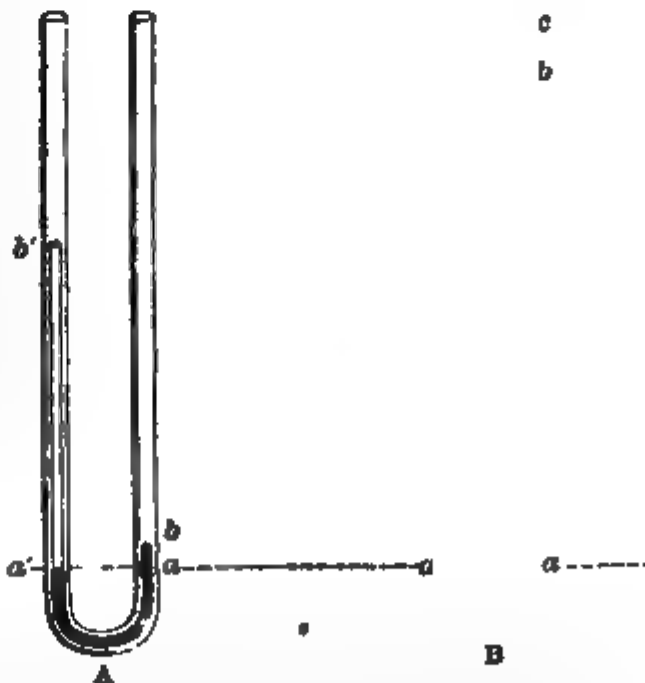


Fig. 256.—A, LONG COLUMN OF WATER BALANCING A SMALL COLUMN OF MERCURY; B, LONG COLUMN OF AIR BALANCING A SMALL COLUMN OF MERCURY (SYPHON BAROMETER).

have asserted, that a column of air from sea-level to the top of the atmosphere of this area in cross-section would weigh about 15 lbs.

It is this pressure of the atmosphere which forces other liquids up a tube from which the air has withdrawn. Thus, if you place one end of a glass tube into water and suck the air out (Fig. 257), water is forced up by the pressure of the atmosphere, and if you could suck the air out completely from a very long tube, the water-column would rise as high as thirty-three feet, this being the length of column the air will support. Mercury is 13½ times heavier than water, so that the mercury-column, under such circumstances, only rises about 2½ feet, or thirty inches. The pressure of the atmosphere varies, and the barometer is an instrument for ascertaining this variation.

Fig. 257.—PRESSURE OF ATMOSPHERE
SIMPLY ILLUSTRATED.

HOW TO MAKE A BAROMETER.

Procure a piece of glass tubing about forty-four inches long. Clean the tube well by passing a wire through it with a tuft of cotton at one end. Now dry it thoroughly. Seal up one end, and about eight inches from the open end bend the tube round parallel to itself. This is the barometer tube, and it now requires filling with dry mercury. Heat the mercury in a porcelain basin to about 120°C., and while the tube is supported horizontally, with its

shorter limb uppermost, pour into it the hot mercury. To do this effectively you require to make a small funnel (a, Fig. 258) with a horizontal stem, just a little



Fig. 258.—FILLING A BAROMETER TUBE:
a, FUNNEL FOR POURING IN MERCURY;
b, POSITION OF FUNNEL WHEN IN USE.

longer than the shorter limb of the barometer tube. The mercury is now poured down this, as placed in Fig. 258, b, and soon the tube is quite full up to the bend. Upon now placing the tube in an upright position, with the thumb over the open end, the mercury in the longer limb sinks, and an empty space is produced at its upper end (Fig. 256, b). A tuft of cotton is now placed in the end of the open limb, to keep out dust, &c.

Our barometer tube has now to be mounted on a board, as in Fig. 259. A scale of inches and tenths must next be gummed by the side of the lower and upper limbs, the inches in both being reckoned from the same level at the bottom, so that when you read off the long column you may subtract the height of the lower one, and thus get the length of the mercury column which is supported by the atmosphere. Before commencing to enter your observations on charts you had better compare the indications of your barometer with one that is to be depended on.

Fig. 259.—
BAROMETER.

When you are satisfied with its working, then you may make charts similar to the one on next page, and enter your observations every day at some particular hour which most suits your convenience. The way to jot them down is apparent. Supposing the reading of the baro-

meter is 30.9 inches on the first day of the month: you make a little cross opposite 30.9 and on the line answering to the first day. The accompanying chart (Fig. 260), giving the results of a month's observations, will show you how it is done.

Barometer.

DAYS OF THE MONTH.

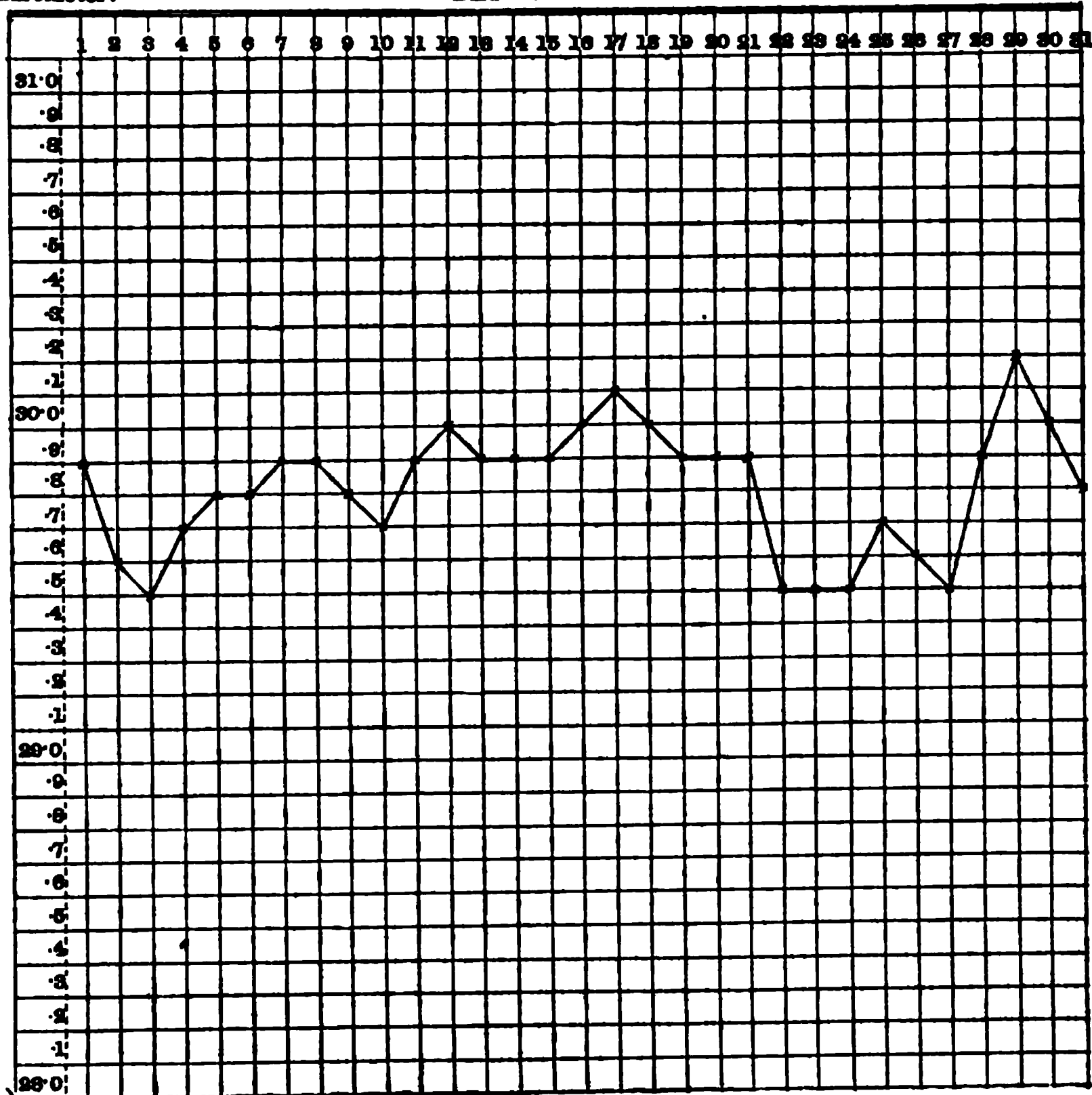


Fig. 260.—BAROMETER CHART.

THE PUMP.

By a mechanical contrivance known as the pump we can make use of this pressure of the atmosphere to lift up water from depths not exceeding thirty-three feet. The only difficulty you will have in understanding this instrument will be in the action of the valves. Suppose you have a pipe (A) with a circular plate fixed in it at *a b* (Fig. 261). Further, suppose that this circular plate has a round hole in it, which a piece of stiff leather fixed at one end quite covers. You may now pour water into A, which will soon fill, because the leather prevents the water from passing through. But if you turn the tube upside down you will find that you can pour water through now, as the

leather is driven from the hole by the weight of the water. Such a valve, then, will permit water to flow in one direction and not in another. In the ordinary suction pump the valve at *a b* is of this kind, and it will allow water to flow only in the direction of the arrow. At *c* (Fig. 262) there is also a plug, which is air-tight, and is moved upwards and downwards by means of the handle; it has a hole through the middle of it, covered by a flap of leather, so that it also permits of air and water flowing only in the



Fig. 261.—ILLUSTRATING THE ACTION OF A VALVE.

direction of the arrow. Thus the pump acts: When the plug (*c*) is pushed downwards, the air in the chamber (*c a*) suffers slight compression, which closes the valve of *a b* and opens the valve of *c*. On its journey upwards the valve of *c* falls to, carrying the air before it, and the air in the chamber (*c a*) is more rarefied: some of it has, in fact, been sucked out by this movement of the plug. Water rises from the well to supply the place of the removed air, and the plug (*c*), on its next journey upwards, has water rushing through its valve instead of air, and since upon its upward journey the valve shuts to, the quantity of

water above it is carried up and turned out of the spout. We will next turn to consider how we may lift weights with ease and advantage.

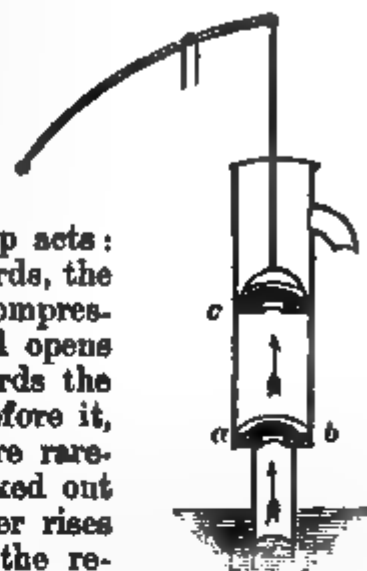


Fig. 262.—SECTION OF A SUCTION PUMP.

LIFTING WEIGHTS.

Robust lads delight in trying their strength, whether in wrestling, throwing the hammer, or lifting weights; and even men who, as a rule, do not give themselves up to ordinary sports are tempted at times to try how many pounds they can lift. Their unaided efforts are, however, puny compared with what weaker men can do when aided by mechanical contrivances. Let us take an example. It would be impossible for a very strong mason to move a heavy block of stone by strength of body alone, but the same block may be moved by a weakly man with a crowbar, and lifted to a height by means of a crane. Now all the devices that civilised man applies for lifting weights or overcoming resistance may be included under the heads of *lever*, *pulley*, and *inclined plane*.



Fig. 263.—THE CROWBAR.

The crowbar presents us with the simplest example of a lever, and you have seen it used scores of times in the ordinary operations of life (Fig. 263). You seize hold of one end (*a*) of the bar, and place the other (*b*) under the thing to be



Fig. 264.—SIMPLE LEVER.

lifted, and now a prop or rest (*f*) is placed under the crowbar, as near to the heavy weight as you can get it, and upon pressing down the end (*a*) the weight will be moved. The rest (*f*) is called a *fulcrum*. You perform precisely the same operation when you stir up the fire, the coal being the weight to be lifted, the grate-bar the fulcrum, and the poker the lever. The advantage you gain in

employing a lever of this kind depends upon the relative length of the arms of the lever ($a f$ and $b f$). If in the example we have taken $a f$ be three times longer than $b f$, then a weight applied at a will lift treble the weight at b —or, in other words, you will be able to move the object with one-third the strength you would have to exert if you applied the hands alone to it.

Two simple levers of this kind are often employed with a common fulcrum, as in a pair of scissors or pincers; here the joint is the fulcrum for both limbs of the instrument.

If the two arms of the lever ($a f$ and $b f$) be equal in length (Fig. 264), then no advantage is gained, for the power applied at a must be equal to the weight at b , and we put such a lever to the common use of weighing goods. The arms of the balance for weighing purposes must be perfectly equal, or else the tradesman cheats either himself or his customers. You may, however, by calculation get a correct weight even with an incorrect balance. If, for example, a substance weighs 10 lbs. when placed in one pan, and $12\frac{1}{10}$ lbs. when placed in the other, correct weight is obtained by multiplying these apparent weights together ($12\frac{1}{10} \times 10 = 121$), and then extracting square root of the product, which in this case is 11 ($\sqrt{121} = 11$).

There are two other kinds of levers the fulcrum which is differently placed, with respect to the weight than in the simple lever we have so far considered. wheelbarrow furnishes us with an example of one, the in the middle being the weight, the point where the wheel rests the fulcrum, and the power being applied at the handles. The treadle of a sowing-machine gives us an illustration of the remaining kind of lever. Here the fulcrum is the hinge, about which the foot-board turns, to which a connecting-rod is attached at the other end, while the foot or power is applied between them.

And now we come to the pulley (Fig. 265), which is nothing more than a small wheel with hollow rim, over which a rope may be drawn. For lifting purposes several of these pulleys are generally employed in blocks, and only one cord is used in the example we shall here consider. The upper block (A) with two pulleys in it is fixed to the beam, and the lower one (C) is movable. One end (z) of the cord being attached to the end of the fixed block, winds round each pulley on its way to the person who is pulling up the weight. Now, nothing is easier in the world than to tell what advantage you gain by such a contrivance. There is only one cord connected with the lower block, but draw a line ($a b$) between the two blocks, and count the ends of cord (1, 2, 3, 4) leading to and from the lower block. There are four such ends; then, by such a system, you can lift four times more than you could by your unaided strength. And thus, by means of such a device, you verily become a Samson, because if you can lift one hundredweight unaided, you may now lift four cwts., or one-fifth of a ton.

Let us next consider the inclined plane. We have its advantages exhibited in every gentle incline, which is much easier both for man and beast to get up than the same amount of rise in a very steep place. The waggoner there is fully aware of its practical advantages, for he takes care to roll his barrels on to the waggon up a couple of planks, as he finds this method much easier than lifting

them straight from the floor. He, moreover, finds that the longer his planks are the easier he rolls up his barrels, from which it would appear that the advantage



Fig. 266 — INCLINED PLANE.

gained has some relation to the length of the inclined plane, as compared with its height. The precise relation is this: Suppose the height of the plane or waggon is 4 feet, and the length of the plane or the planks is 12 feet, i.e., three times longer (Fig. 266): then the waggoner

can put a barrel on to his waggon three times heavier than he could manage by direct lifting with his arms alone.

PRACTICAL GEOLOGY.

A RAMBLE.

WHEN out for a walk we often proceed in a very aimless sort of way, in fact, with no end in view whatever, except to complete a certain round in a given time. If the sun shine on us, and the weather hold out, we are content to trudge away, get our number of miles done, and then land home again. Very different is it, however, when we walk out with an object: to see all that can be seen, to discover that which is hidden from ordinary eyes, and, in short, to increase our stock of knowledge at the same time that we are improving our health. Such a pedestrian will make many pauses in the course of his journey, but at each pause he is either admiring the scenery, scrutinising some plant, or examining some mineral specimen, and from this he derives a pleasure which is not to be bought with money. Such a person, again, when travelling by rail, is keenly interested in the various objects he passes, and if for lack of company he turns his attention to the country he is hurrying through, he is not long in making shrewd guesses as to the nature of the ground over which he is passing, and that alone from an inspection of the dwellings that are built upon it. Thus he would reason:—“The houses of the poor about here seem all to be made of brick. There must be a clayey soil, because bricks are made from clay.” After a while, in the course of his journey, he sees that the nature of the ground has quite altered, for now he passes through many tunnels, sees many hills, and the houses of rich and poor alike are built of sandstone. There is sandstone of some kind, therefore, underground, and should he happen to spy any indications of a colliery he is able to place this particular sandstone in its place among the rocks of the earth's crust. And so he goes on observing. The science which teaches this kind of knowledge is Geology.

To the geologist, therefore, each water-worn pebble preaches an eloquent sermon, each cutting or quarry is an open book for him to read, and even in the very outline of the hills he learns lessons that are thrown away on ordinary observers. Our youthful readers will see, then, that just as swimming or bathing tends to increase their bodily health, so a practical study of the elements of this science will help to increase their health of mind, nay, there are not wanting those who maintain, with good reason, that field geology is in itself calculated to produce a sound body as well as a sound mind.

THE EARTH CUT IN TWO.

As you are aware, the round world on which we dwell is in shape something not unlike an orange. Now, suppose we could cut the earth in two as readily as an orange, what should we see? Did you ever see the liquid iron—liquid because

of its great heat—within a large cauldron at an iron foundry? Well, it is highly probable that the inside of the earth we should see in our section would be as liquid and much hotter than this molten metal within the large cauldron. All the liquid matter of the earth's inside is held there by the shell of solid earth which surrounds it, and when, as not unfrequently happens, a crack is made in this shell, hot substances of all sorts are hurled forth, and the flowing hot liquid pours out of the vent, burning up everything that happens to be in the line of its flow; we get then eruptions like those of Etna, Vesuvius, and Hecla. As it is now, so it has been for untold ages past, and in these islands of ours, although we have now no active volcanoes belching forth the hot substances of the earth's inside, we have proofs that such volcanoes once existed all over the country. We have gigantic examples of this sort of thing in the Giant's Causeway and Fingal's Cave, which are made up of the material poured forth from some large volcano that existed ages ago; and in the course of our rambles we occasionally come across examples of undoubted volcanic action, where there are ashes and substances of various kinds whose nature has been quite altered by contact with the hot lava stream, as the molten material flowing from a volcano is termed.

THE EARTH'S CRUST NOT STEADY.

It will readily be understood that there are agencies at work deep down in the earth whose nature we can only guess at, but sufficiently strong to sway the shell of earth or earth's crust backwards and forwards with apparent ease. At such times we are troubled with earthquakes. The disturbance may be only a slight one, scarcely noticeable, or it may be so extraordinary that the very foundations of the earth are shaken, the sea seems to leave its bed, and men's habitations are destroyed as easily as if they were made of matchwood; such was the great earthquake of Lisbon, on November 1st, 1755.

Besides these sudden movements of the earth's crust, there are others so steady and so slow that they would not be noticeable during the lifetime of one person if he were not in some way inconvenienced thereby. Thus, the fishermen and pilots on the coast of Norway know that the shallow water among the islets has during their time become shallower, and Government officers have had marks cut into the hard rocks at a certain height above the sea-level, and these marks have afterwards been found higher than when originally chiselled out.

On the other hand, there are places which are or have been gradually sinking, as at Malmö, at the southern point of Sweden, and even some parts of the English coast, as at Cromer, Norfolk, where the Scottish fir, yew, pine, and other tree remains have been found at a place now regularly overrun by the sea.

THE STORY OF A PEBBLE.

And now we turn to the tale a pebble would tell us supposing it could speak, and its history is a most interesting one. For a long, long time—we cannot tell how long—it has been knocked about in the bed of the stream among the host of other pebbles which surround it. This rubbing to which it has been subjected has worn off its corners, so that now it is round and polished; and nearly all the other stones about it are round and polished. What has become, then, of the material which has been rubbed off all these pebbles? The present state of things does not give us an answer, for the stream is nearly dried up with the scorching heat of summer, and what water there is proceeds lazily along, as if in no hurry to reach the sea where it is bound for. The state of affairs is quite different at another season. The river then has overflown its banks, its yellow turbid waters rush onwards at a break-neck pace; and what a noise there is at the

weir, which before was dry and silent! Its volume is being constantly increased by the water from a thousand runnels, the torrents from a hundred cloughs, and

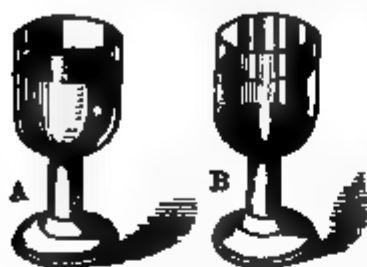


Fig. 267.—TURBID RIVER WATER.

each of these helps to make the river of its present colour—yellow. Carefully take out a glassful (A, Fig. 267) of this turbid water, and put it on one side for a while. In a few hours it is much clearer, and a sandy sediment has settled down to the bottom (B, Fig. 267). This settlement of sediment is the first step in Nature's process of rock-making, for the rushing river carries its burden of fine sand and mud to the sea, and these suspended matters are then dropped to the bottom. Now, if we could get at the full history of our pebble we should find that it had passed through a round of changes,

which commenced in the way we have now sketched, when all its particles were conveyed by some ancient river and deposited at the bottom of the sea; then, by a series of subsequent events, it was made into hard rock, and probably millions of aeons after this, having been elevated above the surface of the sea, a bit of this selfsame hard rock was broken off, and somehow getting into the bed of the stream, was worn into the rounded pebble we have been handling. It will be interesting for us to follow this process of rock-making.

ROCK-MAKING.

When we think of the big black mountains which rise up to the clouds in the English lake district, of the white chalk cliffs that bound a part of the coast, or of the vast masses of sandstone which largely make up the Pennine range of hills, one naturally asks—“Where has all the material come from to make them, and where were they made?” Let us take the sandstone first.

If you were to follow

the course of the river we have mentioned, you would find vast beds of sand at its mouth, the accumulation of centuries (Fig. 268). And respecting these deposits we can think out certain facts. In the first place, you will perceive that as the river at flood has borne along particles of various sizes, the heaviest or largest would fall down first, the lighter particles would be carried farther out, and very fine sediment indeed would be deposited miles away out into the sea. Thus, in

Fig. 268.—THE MOUTH OF A RIVER: A, SECTION, B, PLAN OF DEPOSITS, 1, 2, 3.

the course of a few miles the nature of a deposit would differ very much in degrees of fineness. Another matter:—It appears not improbable that each deposit would be separated from the one preceding and the one following, so that if we could cut through thirty or forty feet perpendicularly this layer-like arrangement would be very apparent. Now, all these things you may notice elsewhere in the course of a day's walk. If you go into any sandstone quarry you see the layer-like arrangement, each *stratum*, or layer, being parallel to the others. You will doubtless also notice that while in a particular quarry the sandstone is so coarse that it cannot be utilised for building purposes, in another quarry four or five miles away the stone is fine-grained, and in great demand. As you stand there and ponder over these facts, comparing what you have thought out in the one case with what you have seen in the other, you are drawn irresistibly to the conclusion that these rocks you are gazing at were once part of some great river mouth or estuary bottom, that all this sandstone was once loose sand, which has since been hardened by the very great pressure of overlying masses of sand and water, and probably also by the cementing influence of chemical action. There then came a time of gradual upheaval, and in course of ages it came about that what was once sea-bottom became dry land. But after it became dry land there was no rest for it, so that in some parts it became elevated, and in others depressed again. Thus it happens you now see, instead of a continuous horizontal arrangement of their beds or *strata*, that in some places there is a break in them, and in others they dip downwards, and they may even appear to stand on end. A break in a set of strata is called by the

Fig 269.—A "FAULT."

geologist a "fault"; and if you examine one of the Geological Survey's maps you will see that in some parts of the country they are more common by far than the hills themselves. Fig. 269 will give you a precise idea as to the nature of a "fault," in which the set of strata, *a b c d e f*, were once continuous with those on the other side, but by some means or other the continuity was broken, so that now the stratum *d*, for example, is perpendicularly 100 feet or 100 yards above *d'*, with which it was once joined. And since the time when this break occurred it is further evident all the strata lying above *f'* have disappeared from the top of *f*; in other words, the surface of *f* has been laid bare, or *denuded*, and this denudation proceeds so very, very slowly that some of these "faults" must be of a very great age. To make this plain, suppose that the strata above *f'* are 100 feet thick, then if, after the "fault" was produced, the strata were worn away at the rate of one foot per year, to denude *f* it would take 100 years, and the "fault," roughly speaking, would be 100 years old. But in this process of denudation only a small fraction of an inch of material per year is worn away, so that such a "fault" would be vastly older than we have put it. Thus, the average rate of denudation or wearing away the surface in the Mississippi basin is $\frac{1}{125,000}$ th of an inch per year, and the rate in the case of the Ganges basin is $\frac{1}{17,000}$ th of an inch per year. Well, then, just as slowly as the material is supplied must the rocks be made: nay, more slowly, for this deposition of sediment we have been speaking about is only the first step, and the hardening and elevating may take as long again. And if it has taken a million and a half of years for a thickness of 100 feet of land to be worn away, it may have taken quite as long for the sandy deposit to be made into hard rock once more.

THE LIFE OF THE PAST.

Indeed, so long ago is it since some of these rocks were made that the specimens, or moulds, of dead animal or vegetable matter which happen by

chance to have been embedded in them are quite unlike the life of the present day. Take a walk to some pit mouth, and examine minutely the shale, &c., that have been tipped on one side; you will find all sorts of queer-looking vegetable and animal remains by vigorously turning over the *débris*—fern-like fronds (Fig. 270), cucumber-like roots that are many-jointed, and glistening scales and other remains of extinct fishes. Even in the common sandstone quarry you may often see vestiges of vegetable life and little prominences on the flags, which are supposed by geologists to be casts of

Fig. 270.—PART OF ONE OF THE FERNS OF THE COAL.

worms which used to burrow in the sand. And a very common appearance is that of the ripple mark in solid stone (Fig. 271), very similar to what you may see at any time on a shore which is washed by minute waves or ripples. If, however, you happen to be in a limestone district, you will see that it is teeming



Fig. 271.—SECTION OF RIPPLE-MARK.

with evidences of past life. Here is a bit of limestone (Fig. 272), such as you have probably many a time picked up: it is crammed full of many-jointed cylindrical bodies. Some of these are broken straight across, and you only see their circular sections. These are what are called sea-lilies, or crinoids; and as they live only in the sea, it would appear as if this limestone had been formed at the bottom of the sea from the inorganic parts of living plants and animals. And so it is now; at the bottom of the oceans deposits are being slowly formed, which will probably be the chalk or limestone of future ages. It requires no

Fig. 272.—SMALL PIECE OF LIMESTONE.

vivid imagination, therefore, when you are out examining quarries, and these *fossils** or vestiges of the past, to form pictures of things as they once

* From the Latin, *fossum*, dug; so that literally a fossil is something dug up. The geologist applies the word only to animal and plant remains of past times.

were, and to read sermons in stones of a singularly interesting character. Suppose, then, you are bent on having a day out in the "field"—i.e., a day of working geology—how would you proceed?

FIELD WORK.

For work in the field we require a few simple instruments. A hammer is the first essential, for breaking up pebbles, detaching small specimens of rock, &c. The form of hammer given in Fig. 273, *a* is generally found most efficient; but our young worker need not be very particular about this, as he may make a



Fig. 273.—THE HAMMER.

good geologist with very indifferent tools. If he, however, decides to have this form, let the handle be of ash, fifteen or sixteen inches long, and it will be found better to fasten on the head (*b*) with a wedge of wood than of iron.

The next essential is a magnifying-glass, an ordinary pocket lens, to examine the various specimens that the explorer comes across.

And now we require a map of the neighbourhood we are exploring, a compass, and a clinometer. The map and the compass are, of course, to get our bearings as we trudge along, and

any heights we require may be obtained by means of a pocket aneroid barometer, where these heights are not already marked down for us on the Ordnance Survey Map.

The compass may be an ordinary one, and care must be taken to make allowance for the magnetic variation (p. 515). Some geologists find it best to adjust the compass-card so that the north of the card is the true north; and they find it sufficient to do this only once a year, so that if the variation be, say, 22° west, the card will be so altered in position that the north end of the needle lies over a point on the card 22° west of the north point, as roughly shown in the diagram (Fig. 274), and now all the points of the compass-card are pointing in the proper directions.



Fig. 274.—ADJUSTING THE COMPASS CARD.

The clinometer is an instrument by means of which one ascertains the dip of a bed of rock. A rough but handy clinometer may soon be fitted up by making a quadrant of cardboard, and to the centre of the arc attaching a string, with a weight at the end for a plumb-line. One may readily read off the degree of dip with such an instrument, by first getting the top edge horizontal by having it perfectly at right angles to the plumb-line, and then noticing how many degrees the beds are inclined to this horizontal. In Fig. 275 the incline is about 25° . Instead of the plumb-line we might have employed a spirit level, but although the instrument in this case would have been much more delicate, it would also have been much less practical. Sometimes clinometer and compass are combined, the latter being in the body of a box with a couple of spirit levels, and the clinometer being formed of the box-lid.

Fig. 275.—ASCERTAINING THE DIP OF STRATA.

On our excursions a note-book ought always to be carried, into which full and

copious notes of the smallest matters are entered, for such notes, although apparently at the time of no use, may subsequently be found to be of the greatest value. The probability is that at first your notes will not be copious, but you will get readier at note-making after a time. Here are the notes of a beginner's first excursion, which are not very full, and probably would have been of worse quality had there not been a very obliging professor conducting the class:—

Thanet Sands.
Unworn Flints.
Chalk.

"Took train to Dorking from London; walked thence to Leith Hill.
"Saw from there the extent of the Weald — north to south. Then walked back to Dorking.

Fig. 276.—SECTION OF A CHALK PIT.

"Marked the peculiar character of the green sand escarpments, the dip of the north chalk downs (about $1^{\circ}5$), the accumulation of water in ponds, &c., over the gault, and the nature of the ground over the Hastings sands in the middle of the Weald." Not a single diagram accompanied this sketch of a day's work. Turning over the pages of his note-book we find farther on that he has become readier at taking notes, and intersperses them, as he ought to, with diagrams (Figs. 276, 277). Thus he reports a subsequent excursion:—

"Went by train to South Croydon, and walked from there to Croham Hurst, and on the way examined a chalk pit. Saw here the Thanet Sands, very thin, and running out altogether in a few miles. The flints were unworn, and in some cases tinted with a greenish (glauconitic) covering. This is a rough section of the chalk pit (Fig. 276).

"*Croham Hurst*—An admirable example of an outlier. It is a Tertiary patch, surrounded by chalk on all hands. The surface is covered with well-worn and rounded flint pebbles, constituting part of the Oldhaven beds. These pebbles are derived from the denudation of the chalk, and to be so derived some idea of the enormous amount of denudation necessary may be formed when one considers the thickness of these pebble beds.

"*Croham Hurst* is about 500 feet above sea level. In the distance can be seen on an elevation of apparently the same height the Crystal Palace, which stands on the South London beds.

"*Widmore Pit*, near Bromley, was next visited. Here brick-making is carried on. We found at this place a good example of a synclinal, the dip of the beds on one side being opposed to that on the other, as per sketch (Fig. 277).

"We found some fossil leaves here; the chalk was not exposed. Farther on we came to where the chalk was exposed, the section being similar to that given in Fig. 276."

Now, in these examples from a student's note-book you see that many matters are mentioned which to most people would not seem worth the trouble of jotting down; but when you are out for a ramble you must consider any geological fact worth the trouble of noting. And then, again, as to the names of strata. It is customary for geologists to name them from the locality where they

Fig. 277.—SECTION AT WIDMORE.

appear to greatest advantage, so that you are constantly coming across names of places, as in the extracts we have just given. This naming of rocks or strata will be one of the first difficulties you have to overcome. There are very few towns now without a museum, and generally the greater portion of it is devoted to the geology of the surrounding neighbourhood. Let this place, therefore, be your resort for many an afternoon, until you have learnt to name the strata and fossils correctly. If the curator be kindly disposed he will be able to give you many a valuable hint and settle many a difficulty for you.

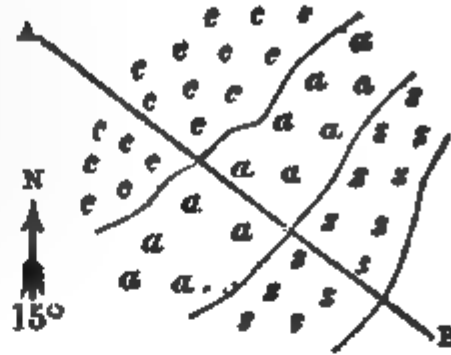


Fig. 278.—MAPPING.

MAP DRAWING.

Whenever you can manage it you must make maps—roughly, of course, at first—and then make them more



Fig. 279.—HORIZONTAL SECTION.

and more correct by subsequent observation. In travelling over a country, suppose we find chalk, clay, and sand. We have before us a map of the district, and we mark each spot *c* where chalk is found, *a* where clay, and *s* where sand. We get in this way a rough and ready sort of geological map of the district. We have next to ascertain the relation each of these beds bears to the other. We therefore take (Fig. 278) some definite direction (*A*) across the map, and by constant observation learn every particular which will help us to draw a section: the dip of the chalk beds, how they stand with respect to the clay, and the position of the clay with respect to the sand; and our observations we are able finally to generalise in some such sketch as this (Fig. 279), where *c* is a chalk down, *a* a bed of clay dipping under it, *s* a mass of sand really passing under the clay. Fig. 279 is termed a horizontal section, in contradistinction to sections which are sometimes drawn to show the order of the strata alone and the thickness of each stratum. Such a section is known as a vertical section (Fig. 280). In making

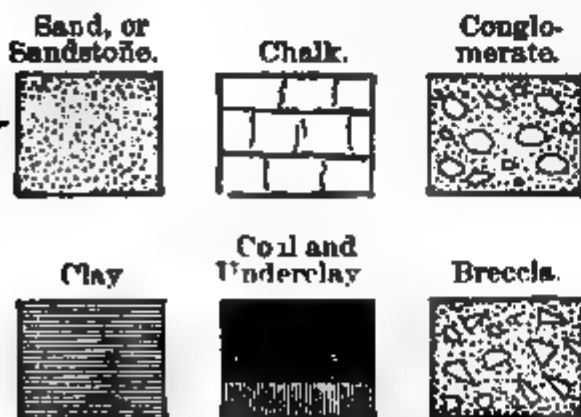




Fig. 281.—HOW THE NATURE OF STRATA MAY BE REPRESENTED.

these vertical sections you must be careful not to take the extent of surface exposed as the thickness of the stratum. Thus it would be wrong for you to take *d e* (Fig. 279) as the thickness of the clay bed, for the real thickness is evidently less than this or the line *d f*. Hence, before you can tell the thickness of any bed that may be exposed in a section you have to ascertain its dip, which is sometimes an important matter, for if you gave *d e* (Fig. 279) as the thickness of a bed of coal, you would evidently

Fig. 280.—VERTICAL SECTION.

be very much out if the bed were to dip, say, at an angle of 45° , because the thickness would be *d f*. On a map the direction and degree of dip may be thus

represented , the point of the compass being above the arrow, and the number of degrees  under it. You may often be at a complete loss for information as to the nature of the strata below you, and at such times, if there happens to be any boring for wells or anything of that sort in the neighbourhood, you may get a great deal of the required information by examining the boring.

In drawing vertical sections it, of course, does not matter much about width, the great point to attend to being accuracy in giving vertical thicknesses. You may paint the various beds in your vertical section limestone blue, igneous rocks red, and so on, keeping as near as you can to the colours geologists use for this purpose, as given in the Index of Colours generally accompanying the

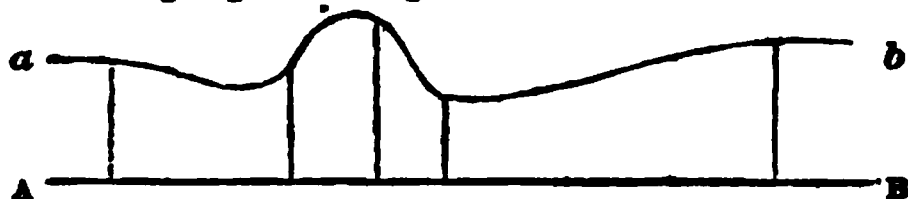


Fig. 282.—DRAWING A CONTOUR LINE.

Geological Survey's Map of Great Britain. It is usual also to indicate the nature of the beds by peculiarities of drawing, as you will have perceived in Fig. 281.

Thus:—For horizontal sections one requires some general idea of the form of the ground. The heights may generally be obtained from Ordnance Survey Maps, and a contour line may then be obtained (Fig. 282) by first drawing the horizontal line (A B), to represent sea-level, and jotting down the heights of places over this line, so that when the relative height of each has been put down according to the scale you are employing, then you draw through these dots denoting heights a free outline (a b), of the hills and valleys. One is generally justified in making a section down to sea-level, and sometimes geologists will carry it a thousand feet below this line, but unless there be deep wells or mines upon which their data are founded, it will be understood that this below sea-level section is purely supposititious.

Here we end, and if you have patiently studied what has been said on the more elementary aspects of sound, light, heat, electricity, magnetism, chemistry, and practical geology, you will have added to your sources of enjoyment in days to come, to say the least of it; and if it should so happen, in addition, that the study of these short chapters has made you determined to follow science devotedly in your leisure time, then it may very possibly come about that you also will be classed among that noble band of benefactors to mankind whom we name discoverers—a lot which has been prayed for by many, and only attained to by a few.

THE WORKSHOP.

BY DAVID BREMNER, AUTHOR OF "THE INDUSTRIES OF SCOTLAND."

To youths with a taste for mechanics an assortment of tools and a convenient place in which to practise their use are valuable possessions, and provide the means of agreeable relaxation from study when out-of-door recreations are either impracticable or undesirable. Working in wood or in metal is a fascinating occupation for those whose predilections lie in that direction, and parents would do well to encourage it. The lives of not a few of the greatest engineers and inventors the world has ever seen show that their peculiar genius was first roused to activity by their having access in boyhood to tools and workshops. Of course it is necessary before entrusting hammers, hatchets, and chisels to boys, to consider whether they are likely to use them for purposes of construction or of destruction. If the former, let them have them by all means; but if the latter, withhold them. In the one case the youth will seek out pieces of wood and endeavour to convert them to some useful purpose; in the other he will be found disfiguring the furniture, or driving nails into doors and windows everywhere. In this last form we must dismiss him from our consideration. We shall suppose that we have before us the youth who will work constructively, and proceed to give him some hints as to the fittings of his workshop, the choice of tools, and how to make various articles which may prove useful to himself and others.

CARPENTERING AND JOINERY.

FURNISHING THE WORKSHOP.

It is not difficult in any middle-class house to find some small room or corner of an attic or out-building suitable for conversion into a workshop. Of course it is best if a small apartment can be secured exclusively for the purpose in view, as in that case there is less likelihood of work in progress being disturbed, and besides, the boy or boys of a family will take more pride in a place they can call their own. The apartment should be well lighted, for the chances are that it will be occupied chiefly on dull or wet days, when its value will be most highly appreciated.

The first thing to be introduced in the way of furniture is a bench, for without that, or some substitute for it, little can be done. A stout kitchen table will suit very well for all lighter kinds of work; but as some of our readers may wish to possess a proper bench, we will describe how one may be constructed without much trouble or expense. It is easy in these days to obtain in every town or village timber cut to any size. For a bench of convenient dimensions the following would be required to begin with:—Four pieces measuring three inches square and three feet in length, with which to form the legs; one piece eighteen inches broad, one and a quarter inches thick, and five feet in length, to form the top; two pieces four feet in length, eight inches broad, and three-quarters of an inch thick, to form the top side rails; two similar pieces sixteen inches and a half long, to form the top end rails; a set of four pieces similar to the four last described, but only four inches broad, to form the lower rails. This would make a strong and really serviceable bench; but where the work contemplated would not be of a heavy kind lighter proportions might be adopted. The wood should

be purchased ready planed, so that all that would be necessary would be to put it together. This should be done with screw nails, which are in many cases preferable to driving nails, especially in amateur work. Screws two inches in length and of medium stoutness would answer very well, and of these four or five dozens would be required.

Of course it is impossible to proceed without tools of some sort. To make holes



Fig. 1.—HAND SAW.

for the screws a gimlet (Fig. 2) will be wanted, and without a screw-driver little progress can be made. A hammer, a plane, a saw (Fig. 1), and a square will also be useful in adjusting the wood and fixing up the bench. All these may be

purchased for a small sum, and will constitute the foundation of such a set of tools as will be required when other joiner-work is undertaken. When boys take a fancy to try their hands at joinery they very often make the mistake of purchasing a box of tools wonderful for their number and cheapness, but which cause sad disappointment when brought into use. Chisels and other edge tools made of cast-iron can neither be kept sharp nor subjected to much strain; nor are awls and gimlets made of soft iron very useful. Boxes of well-made and really serviceable tools are to be had, no doubt, if one cares to pay for them; but most boys will find it more economical and convenient to purchase tools separately and as they require them. A great variety of work can be done with a few simple tools, and it would be folly to begin by investing in an elaborate assortment. We will indicate the tools required in the construction of various articles as we proceed. In the meantime we will suppose that the reader has acquired those mentioned as necessary for the construction of a bench.



Fig. 2.
GIMLET.

In joinery, as in most other things, there is no mode of proceeding better than another. Performing different operations in what may be called natural succession is the best in every way. You must lay your foundation ere you can rear your walls. After our pupil has had a simple lesson, such as it is our intention to impart, he will be able, with a little preliminary consideration, to approach his work in the most effective way.

Here are the pieces of wood described as necessary for the construction of a bench. As they lie in a confused heap on the floor their arrangement seems a difficult problem to the novice; but if our pupil will proceed in the order we shall indicate, the difficulty will sound more imaginary than real. To begin, then, let him

Fig. 3.—USE OF
SQUARE.

out from the heap two of the leg pieces, and lay them on the floor side by side, a little distance apart. Next let him set one each of the short top and bottom rails. These he will lay across the two legs, and adjust the latter so that their outer sides will be even with the ends of the rails. The broader, or top rail, will have what is to be its upper edge even or flush with the end of the legs, and the lower rail will have its under edge six inches from the other extremity. If the wood has been cut exactly to measurement and squared at the ends, little trouble will be experienced in making a neat job; but if the lengths vary and the ends be not square, they must be sawn or

planed as required. We shall conclude that the wood has been properly cut. By applying the square in the manner indicated (Fig. 3), the rails and legs may be accurately adjusted. The pupil should now lay his screw-driver and his box containing the screws in a convenient position, and taking his gimlet in hand, kneel upon the broad rail, so as to keep it in position. Four screws will be required for each end of the top rail, and they should be inserted in the positions indicated in the engraving (Fig. 3). It is always unadvisable to put screws or nails into wood in close order and in the same line, as in such a case they are apt to split even the toughest material. By alternating their order this is avoided. Having fixed the upper rail, the lower may be proceeded with in the same way, but as it is so much narrower, two screws in each end will suffice. Now we have completed one end of the framework of our bench; in an exactly similar way must the second end be proceeded with.

The next step is to join the two ends by fixing upon them the side rails. To do this we set the end pieces upon edge, keeping the rails outward, and taking up one of the side top rails, adjust the ends to it by laying the rail upon them, and moving them to or fro until they occupy a position even with the extremities of the rail. The gimlet is again brought into requisition, and in boring holes for the screws care must be taken to keep them clear of the line of those already inserted in the legs, else we may find one screw coming into contact with another, and so causing trouble. In boring for screws a gimlet of less diameter than the screws must be used, so as to leave wood for the thread to cut into. It is usual in dealing with soft wood to drive the screws in about half-way with the hammer, and then send them home with the screw-driver. This expedites the work, and produces no objectionable effect. Having fixed the top and bottom side rails on one side, the work is turned over, and the other side operated upon in the same way. Now the frame is complete, and may be set on its feet, so to speak. By this time the young joiner will be thoroughly interested in his work. He sees before him a tangible proof of his industry and skill, and as he places upon the frame the board which is to form the top of his bench he will be astonished at the rapid progress he is making. According to the dimensions we have given, the top will be found to be the same width as the frame, but a foot longer. Of this superfluous length six inches will be allowed to overlap at each end, for purposes which will become apparent as we proceed. In fixing the top it is necessary that the screws used should not project to the surface, as in such a case planes and other tools might be brought into contact with them. They must, therefore, be "counter-sunk." For this purpose a "bitt," or boring-tool, might be used, but a gouge will answer very well, and it is a tool that will be of frequent service. To the tools already enumerated, then, we must add a gouge half an inch in breadth. A gouge (Fig. 4) is simply a curved chisel, and is employed in hollowing out work generally, enlarging holes, and the like. In order to countersink the screws we must, after using the gimlet, enlarge the upper part of each hole sufficiently to allow the head of the screw to descend an eighth of an inch or so below the surface of the wood. There are other instances in which this treatment of the screws will be advisable, especially in the case of work to be painted, when the holes over the screws may be filled with putty.



Fig. 4.
GOUGE.

Our bench has now the appearance of a substantial, if not remarkably elegant, table. To fit it for use it has to be furnished with a "lug" for holding work, and top and side pegs for the same purpose. All the wood mentioned in our first specification having been used up, we must go to the timber merchant again and procure several more pieces before we can proceed farther. For the lug we

- shall require a piece twenty-four inches long, six inches broad, and one inch thick, and another piece ten inches long, six inches broad, and one inch and a quarter thick. This last-mentioned piece we shall have to cut into two portions diagonally

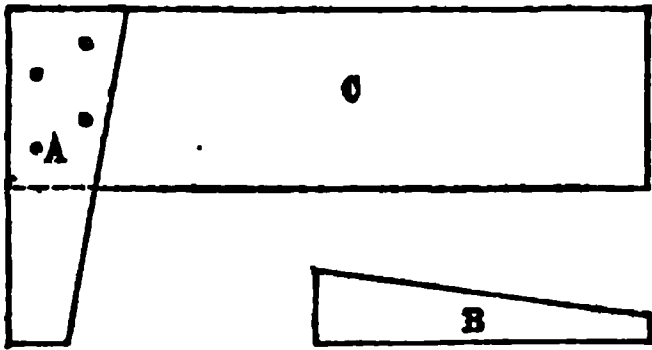


Fig. 5.—LUG OF BENCH.

in a lengthwise direction. One portion is then to be fixed with screws across one extremity of the twenty-four inch piece in this position (Fig. 5). The pieces thus united have now to be attached to what is to be the fore end of the bench. This is done by placing the part C under the projecting end of the bench top, and fixing it there with screws put in from below. It will be observed, however, that the lug might be more conveniently joined to the top before the latter was put into its position; though to avoid complexity in our lesson we did not allude to it before the top was fixed. The top of the bench, with the lug attached, will have this appearance, as viewed from above (Fig. 6). The gap between A and the side of the bench is of the same dimensions as the part B which was detached from A (Fig. 5). The use of the lug is to hold firmly boards or laths while their edges are being planed. The board is placed edge up against the side of the bench, and allowed to project a convenient distance above it, and its fore end is pressed against the shaded part of the lug. The thin end of the wedge-shaped piece (B) is then inserted between it and the board, and driven in with a hammer until it has taken a sufficient grip. By this arrangement a board may be held quite securely while both hands of the joiner are occupied with the plane. If the board be more than a couple of feet in length, however, additional support is required, and this is provided by perforating the upper rail of the bench with holes at intervals, and into one of these, in a convenient situation, inserting a peg of hard wood, shaped like this —, on which the rear end of the board may rest. For holding work while being planed on the flat a peg of hard wood (D) has to be provided (Fig. 6). This is made to fit tightly into the aperture provided for it, and it is adjusted as to height by being knocked up or down with a hammer. Our bench is now complete, and placed against the wall with the fore end in a good light, stands ready for use.

Having become the possessor of this important piece of workshop furniture, the pupil will be eager to turn it to account. While it has been in course of construction, no doubt, his mind has run upon many articles which he would like to try to fashion; but we must curb too ambitious flights, and make a modest beginning. In constructing the bench there was little scope for the use of tools, so that we must look upon our pupil as having only the smallest amount of knowledge on that subject. We shall, therefore, begin by treating him to some slight exercise in the use of the saw and the plane, the most important implements of joinery. We propose to make a reading-stand or book-holder (Fig. 12), which will be likely to prove just as useful as the exercise which its construction will afford.

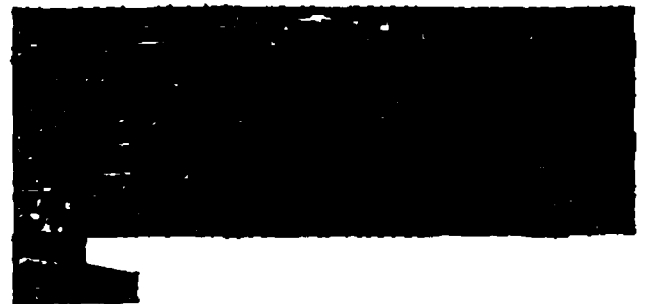


Fig. 6.—TOP OF BENCH, SHOWING LUG.

HOW TO MAKE A READING-STAND.

Here is our material, in the shape of a piece of yellow pine board, a foot in length and an inch thick. This we proceed to saw up into slips three-eighths of an inch in thickness. Of these slips we shall require seven, and one slip an eighth of

an inch thicker. Our design is very simple: it consists of three upright bars, three horizontal bars, a ledge, and an adjustable leg to support the stand at any required angle. The bars we intend to be one foot in length, one inch in breadth, and a quarter of an inch in thickness. The dimensions of the board from which the bars are to be cut provide for the length and breadth, so that we shall only have to study the required thickness. To allow for unskilful use of the saw and some planing practice, we shall aim at sawing the slips at a thickness of three-eighths of an inch, as above indicated.

Laying our piece of board upon the bench, we measure it off into the desired portions, and with a pencil and flat ruler draw lines indicating these. For this part of our task it is best to use a carpenter's pencil. This is a stout article with a large core of lead. It is sharpened so as to have a broad flat edge, which being drawn parallel along the ruler makes a very straight and distinct mark. It is best to measure exactly, and draw lines on both sides of the board, as it may then be seen at a glance whether the work is going on properly. The saw to be used is a "hand-saw" (Fig. 1), and that article we have already supposed our pupil to possess. A hand-saw of fair quality and convenient size may be purchased for five shillings. The hand-saw is used for the most part in cutting wood longitudinally. Its teeth are large, and it takes a good bite. To see a skilled hand using the saw, no operation seems easier to the novice. This, however, is an illusion that invariably becomes dispelled by the first attempt to work the implement. But we must proceed.

As yet our workshop does not possess a trestle—a log mounted on four legs, and used for resting wood upon while being sawn and for other purposes. Here is a superannuated kitchen chair with a stout deal bottom; it will answer our purpose fairly well. The pupil must lay the wood on the chair in such a way that about an inch of the ruled side of it will project from the seat. Planting his left knee on the wood, he does his best to hold it firmly, an operation in which his left hand assists. His right hand holds the saw, and in beginning operations with it he lays its teeth lightly on the end of the board over the pencil line nearest its edge. Gently pushing the saw downward and from him, he causes it to enter the wood. In drawing it backward for the next cut, he does so without pressure, as the teeth do not act in that direction. If the teeth of an ordinary saw be examined, it will be observed that their points are directed forward, and consequently are effective only when proceeding in that direction, when each acts upon the wood like a tiny chisel and chips out a portion. A well-sharpened saw requires but little effort to carry it through the wood; indeed, it does its best work when only slightly pushed, and when wielded with a long, steady stroke. Care must be taken to make the saw move in a perpendicular line, and to guide it exactly along the pencil-mark. In approaching the end of a cut the saw should be handled lightly, so as to prevent splitting. After all, practice is the best teacher, but these hints will prevent mishaps at the outset.

Having cut as many slips as are necessary for our purpose, we proceed to plane them down to the required dimensions, and impart to them a smooth and even surface. This introduces us to the subject of planes. As its name implies, the use of the plane is to give to wood a smooth and even surface. There are three varieties of this tool which the amateur will find useful, and he can do little without one or more of them. These are the "smoothing plane" (Fig. 7), a short implement without a handle, and very efficient in dealing with small surfaces; the "jack plane" (Fig. 8), which measures about sixteen inches in length, is furnished with a handle, and is chiefly used in removing rough surfaces, such as saw marks; and the "trying plane," which is somewhat larger than the "jack plane," gives a flat clean cut, and is employed in smoothing large surfaces, such as panels, and in giving a straight and square edge to boards. The plane may be

described as a chisel mounted in a block of wood, which prevents it from taking a deeper cut than is desired. Planing is a fascinating part of joinery, and affords

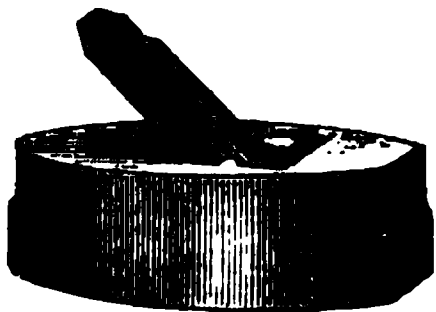


Fig. 7.—SMOOTHING-PLANE.

good exercise for the chest. It is easy to turn off shavings in any quantity, but some skill is required to produce square edges and smooth surfaces. The pupil need not despair, however. He will soon discover the peculiarities of the plane, and by a little careful practice thoroughly master them. His first trouble will probably be the adjustment of the iron. If it protrude from the plane too far it will take off too thick a shaving, or perhaps tear up the surface of the wood, and if it does not project enough no work will be done. Before using

a plane it should be turned upside down, and the position of the iron observed by placing one's eye on a level with the sole of the plane and looking along from the front to the rear end. The extent to which the iron projects may thus be noted, and experience will tell whether it shows too little or too much. If the former, a smart tap or two with a hammer on the rear end of the plane will bring the iron down; if the latter, a blow or two on the fore end will send the iron up. After each adjustment the wedge which holds the iron fast should be driven home, as the tendency of the blows on the body of the plane is to loosen it.

The job we have on hand at this moment is a light one. Let us take one of the pieces we have sawn from the board, and laying it against the stop-peg on the bench, apply the jack plane

to it. The surface is rough, as the saw has wobbled about in the unskilled hands that wielded it. One or two passages of the plane will remove all that. The pupil must stand almost facing the bench, with his left foot advanced, and in such a position that when he



Fig. 8.—JACK PLANE.

pushes the plane forward the swing of his body will assist in the work. Taking hold of the handle of the plane with his right hand, and grasping the front part of the tool with his left, he must lay the plane flatly upon the wood so as to cover it, and feel the lie of its surface. He must then slide the plane backward until the iron, or cutting part, passes beyond the rear end of the wood. As the greater bulk of the tool will now be projecting over the end of the wood, he must balance it by pressing downward with his left hand, and thus keep the sole of the plane and the surface of the wood parallel. If he will now push the plane firmly and steadily forward, he will find the iron bite and see a shaving curl upward. Three or four such steady passages of the plane will suffice to bring the surface to the required condition, and then the other side of



Fig. 9.—CHISEL.

the wood may be turned up and operated upon. Having brought one piece to a convenient thickness, it may be used as a gauge for the others by laying it on the bench and trying them beside it. It is always

desirable to work to measurement, but as in this case all that we require is that the pieces should be about a quarter of an inch thick—their other dimensions having been already determined by the length and thickness of the plank from which they were cut—it does not matter whether they be a trifle more or less than a quarter of an inch, provided they be all alike. At a further stage

we shall show how more exact work may be done, but we do not wish to introduce any more implements here.

Having planed down six of the slips of wood intended for our book-rest, we proceed to trim their extremities. For this purpose we require a chisel (Fig. 9). This is a very useful tool, and should form a part of the earliest purchases of the amateur joiner. Chisels are made in various sizes, between two inches in width and one-eighth of an inch; but it will suffice for most purposes to possess one



Fig. 10. —
END OF
SLIP.

each of the following—1-inch, $\frac{1}{2}$ -inch, $\frac{1}{4}$ -inch, and $\frac{1}{8}$ -inch. With the inch chisel we smooth the ends of each piece, and test them with the square.

One end of each of three pieces we cut to this form (Fig. 10), and treat both ends of two other pieces in the same way. In the case of the sixth piece we have now on hand, only one corner at each end must be cut

away, for reasons which will soon be manifest. Laying on the bench the three pieces of which one end only has been operated upon, and arranging them parallel to each other, and with a space of three inches and a half between them, we adjust to them the three other pieces in the manner shown in the diagram (Fig. 11), and with screws three-eighths of an inch in length fix them together. It will be observed that we put two screws in the central bar at each point of connection. This is to prevent a tendency, which the structure would otherwise have, to yield to pressure from the right or left, and become folded up. The ledge for the books to rest upon, and the leg which is to project from the rear and support the stand, have now to be got ready and fixed. It will be most

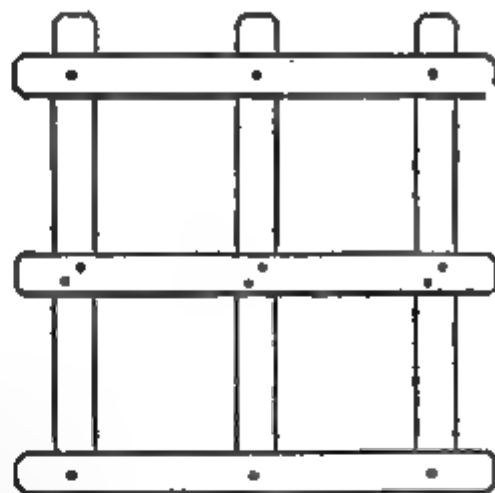


Fig. 11. — PLAN OF READING-STAND.

convenient to proceed with the latter first. The necessary piece of wood has already been sawn. Let us plane it down to the dimensions of the pieces we have already put together. This done, we reduce its length to seven inches by a cut of the saw. Our next requirement is a small brass hinge, measuring one inch by a quarter when shut. This may be purchased at any ironmonger's, though should our pupil become as apt a worker in metals as we expect to see him by-and-bye, he will perhaps prefer to make the hinge himself. As neither screws nor nails hold well in end wood, it is desirable, in fixing one side of the hinge to the upper end of the leg-piece, to use fine screws half an inch in length, taking care not to employ an awl in boring

Fig. 12. — READING-STAND.

holes for them that is not less than the diameter of the screws. The leg-piece, with hinge attached, is now to be laid against the back of the central upright piece of the frame, at a convenient height, which may be ascertained by testing. We must take care that the pieces lie perfectly parallel, and having seen to that, we proceed to attach the free wing of the hinge to the centre-piece with screws of appropriate size.

We next turn our attention to the ledge. For this we require a stouter piece of wood than any we have yet dealt with, as it must, after dressing, be at least three-eighths of an inch thick. Having planed the wood and cut off the front corners, we set it on edge, and fix to it, with four or five half-inch screws, the lower cross-bar of the frame and its attachments. We must now procure two pieces of stout brass wire, about two inches in length, and bend them to right-angles in the centre. These are to form the hooks or fingers necessary to hold a book open while on the stand. With a gimlet we bore a hole within three inches of either end of the front of the ledge piece, and drive the wires into these. The wires should fit tightly, as by use they are sure to work loose in the course of time. This done, we have virtually completed our task, and may set it up for examination or try it in use (Fig. 12). If we are disposed to be critical,

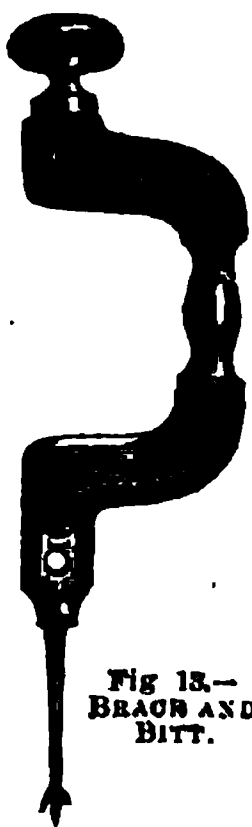


FIG. 13.—
BRACE AND
BITT.

perhaps we may conclude that it would have been an improvement to have given some fancy form to the extremities of the bars which form the frame, or to have softened down their sharp corners by passing the plane over them before they were put together. We must, however, remember that we are but beginners, and that we should not court disappointments by too ambitious attempts at the outset. By staining and varnishing, too, the appearance of our handiwork would be much improved; but we shall not wait now to perform these operations.

HOW TO MAKE A RABBIT-HUTCH.

Our pupil may be a fancier of dogs, rabbits, or birds, and may desire to fashion with his own hands homes for his pets. Let us see how far we can help him. To the amateur joiner old packing-cases are peculiarly interesting objects. He sees in them material already partly prepared for many of his purposes, and by making a judicious selection he may be able to save himself a considerable amount of toil. It is not our purpose to encourage him to avoid labour when such may be absolutely necessary; but we desire, by showing him the easiest way of arriving at results, to stimulate his practice of a healthy recreation. Let us suppose that old packing-cases are within his reach, and that he wishes to convert one into a rabbit-hutch. A box three feet long by eighteen inches in width and depth will make a commodious residence for a pair of rabbits. The first thing to be done is to remove the lid, if it be not already detached, care being taken to avoid splitting the boards. Nails or portions of nails in the lid of the box should then be either pulled out or driven in closely. The nailing of the sides and bottom should be examined, and where necessary made more secure. The least slightly side of the box is to be chosen as the bottom of the hutch, and should now be perforated with a score or two of holes bored with a half-inch "auger" or "bitt." There are many varieties of augers, but a small set of "bitts" and a "brace" will be most serviceable to the amateur. And here we pause to describe these implements.

The brace (Fig. 13) is a portable crank of wood strengthened with brass. At one extremity it has a square aperture fitted with a spring, and it is into this that the bitts, which are of different forms and sizes, are stuck. At the other extremity is a flattened bulb of wood moving easily on a pivot. This bulb, when the tool is being used, is pressed against by the chest, while with the left hand the workman steadies the tool, and with the right turns the crank which urges the bitt to cut its way through the wood. A serviceable brace and a dozen bitts will not cost more than 10s. or 12s. The three varieties of centre-bitts in common use are "quill-bitts," which in form resemble a gouge, and are used

for boring across the grain of wood; "nose-bitts," which are similar in the body, but have a cutter at the tip, which fits them for boring in the direction of the grain; and "centre-bitts" (Fig. 14), which have a central spike and a cutter on either side, and are used to make holes of large diameter and limited depth. Three or four sizes of each of these will be sufficient for most purposes. A centre-bitt will be the best suited for making the holes in the bottom of our rabbit-hutch, and fixing one of the required size in the brace, we proceed. A steady motion of the brace and moderate pressure is best, and the pressure should be reduced when the wood is nearly perforated, else a splinter will be forced off from the under side.



Fig. 14.—
CENTRE-
BITT.

As it is desirable to have two compartments in our hutch, we must now insert a partition. One-half of the lid of the box will provide material for this. Measuring the internal width of the box exactly, we cut off a part of the lid, of the same dimensions. If the measurement be carefully made there will be little trouble in making the partition a good fit. Having cut it, let us try it in and ascertain the result. As the lid overlapped the sides of the box when in position, our partition will be wider than is required, and when we try it in we note and mark how much it projects. The superfluous wood we remove by sawing and a few passages of the jack plane. We must now make a door in the partition, and to accomplish this we measure off six inches from either end of its lower side, and placing our square at those points, draw a line from each towards the centre of the board. As the partition is eighteen inches wide, this will mark off a central space six inches in breadth, which will be wide enough for a doorway. We must, however, allow a height of eight inches. Having connected the perpendicular lines with a cross one at a distance of five inches from the edge of the board, we take a pair of compasses and strike a semicircle from the centre of the cross line, designing to give our doorway what is called a circular head.

This introduces the pupil to what seems a difficult task. Drawing the semicircle is easy enough, but he, no doubt, wonders how the wood is to be cut to that line. We have mentioned compasses, and may add that a stout iron pair will be found most useful, both for measurements and drawing curves. In order to cut along curved lines, a "compass-saw" (Fig. 15) will be required; one with a blade a foot in length will answer most purposes. In making the doorway, we begin by laying the board on some convenient support, and with the hand-saw cutting along each of the perpendicular lines as far as the line which forms the base of the semicircle. We now take our compass-saw, and slipping it into one of the cuts thus made, guide it through the wood along the curve until we detach the portion bounded by the lines. A little practice will enable the pupil to cut curves with accuracy and neatness.

A door must now be made and mounted, as it can be more readily done before than after the partition is fixed. The door may be made either to open on hinges or to slide in perpendicular grooves. We prefer the latter plan, as it allows the door to be raised completely out of the way when it is not necessary to keep the inmates of the hutch apart. A piece of

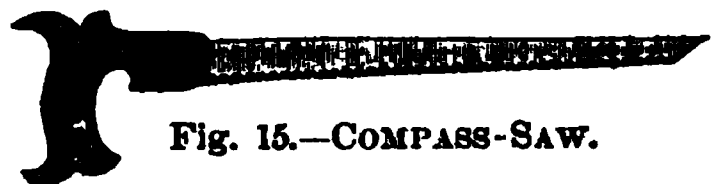


Fig. 15.—COMPASS-SAW.

deal, nine inches long, seven inches broad, and three-eighths of an inch thick, will be required for the door, and for the grooves we must prepare four pieces of the same thickness, but sixteen inches in length. Of the four pieces, two must be one inch in width, and two one inch and a half. One of the inch wide pieces is nailed on each side of the doorway, half an inch

from the edge of the opening. This may be done with "brads" or driving-nails, an inch in length. The other pieces are laid on those we have fixed, so that their inner edges shall project half an inch, and must be nailed in that position. Here we have a groove for the door to slide in. We try it, and finding it rather a tight fit, thin the edges of the door by removing a couple of shavings with the jack plane. In order to keep the door up when it is not desired to have it shut, a hole may be bored in its upper part, and a corresponding hole at a convenient height in the partition, and by inserting a peg into these when the door is raised, it may be held suspended.

Our partition is now ready to be fixed. Here, again, we have a choice of ways of proceeding to work. Suppose we construct grooves into which the partition will slide. Sawing four slips from some convenient piece of board, we reduce them to about half an inch square, and make them of a length corresponding to the width of the hutch. Finding the centre of the length of the hutch by measurement, we nail two of these "fillets," as such slips of wood are commonly called, across the bottom, leaving a space between them sufficient to admit the edge of the partition. The other pair of fillets we fix to the roof in a similar way, turning the hutch upside down in order to accomplish this conveniently. We now slide the partition into its place, and find we have made encouraging progress.

Our next concern will be the doors of the hutch, one for each compartment. For these we require some pieces of wood an inch and a half broad and half an inch thick. These we cut into lengths—four pieces to correspond with the distance from the partition to either end of the hutch, interior measurement, and four pieces to correspond with the internal height of the hutch. Taking two of each set of these pieces, we proceed to construct with them a frame for one of the doors. With square and pencil we draw a line across the end of each piece an inch and a half from the extremity.

Here we may introduce two additional tools with advantage. One is the "back-saw" (Fig. 16), sometimes called the "tenon-saw." This is a saw with a thin blade, strengthened on the back by a fold of stout brass. The tool is made in various sizes. One with a blade twelve inches long will be found suitable for many purposes, but a smaller one will also come in handy for light work, such as model-making. The other tool we refer to is a gauge. The form



Fig. 16.—BACK-SAW.

of this implement is shown in Fig. 17. The longitudinal pin has a metal point or scratcher through one of its ends, and carries a D-shaped block, adjustable at any distance from its scratcher by means of a wedge. By fixing the block a quarter of an inch from the scratcher, we prepare the tool for drawing the line we wish to put on the edges of the piece of wood we are making the hutch doors with. If we hold the piece of wood to be operated upon in the left hand, and seize the gauge with the right, and place the block against the flat side of the wood, we may, by pushing the gauge forward, pressing it meanwhile firmly against the wood, scratch a line exactly in the centre. Turning up the other edge, we repeat the operation, and so on until we have marked each edge of each end of all the pieces. Our object is to cut the ends so that they shall fit into each other, as shown in Fig. 18, and as this form of joinery is likely to be frequently used by our pupil after he is left to his own devices, we describe the operations somewhat minutely. Taking up one of the pieces, we fix it in the lug of the bench in an upright position, and with the back-saw cut downwards along the gauge lines until we reach the depth indicated by the pencil-mark. Cuts of this

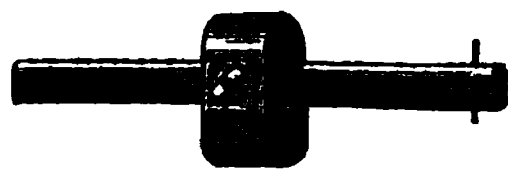


Fig. 17.—MARKING GAUGE.

kind require to be done with a steady hand, and the progress of the saw in relation to the lines closely watched. When we have sawn both ends we lay the piece flat against the peg on the bench, and holding it steady with the left hand, apply the saw along the pencil-line, and so detach the portion of wood we wish to get rid of. Bringing together the four pieces designed to form the frame of one of the doors, after we have operated upon them as above described, we find they fit neatly, and proceed to fix them together. This we do by means of three half-inch screws in each corner, taking care as we proceed to test the arrangement of the pieces with the square.

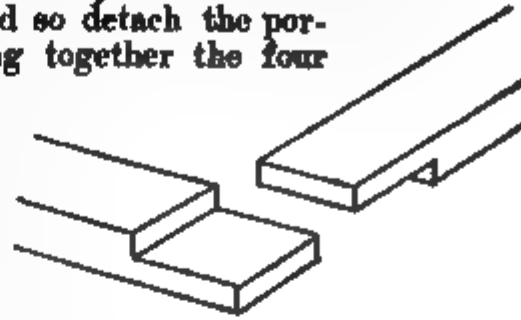


Fig. 18.—CORNER JOINT.

Our next step is to prepare some laths to nail upon the frames, and so complete our lattice doors. Selecting a piece of board about three-quarters of an inch thick, we saw from it sixteen slips three-eighths of an inch thick. These we dress with the plane, and cut to the length required. The angles on what is to be the exposed side may be stripped off, and the ends pared a little for neatness of effect. Taking eight of the laths, we nail them one inch apart upon what is to be the outside of the door. A couple of half-inch brads in each end will suffice. We must next procure two hinges for each door. These may be of iron half an inch in depth, and one inch and a half in length. For their accommodation we must cut pieces out of one side of each door, at a point three inches from the top and bottom respectively. Having done this, and attached the hinges to the doors with screws, we next fix the loose wings of the hinges to the sides of the partition, in a position which will admit of the doors swinging freely (Fig. 19). On closing the doors now it will be found that they have a tendency to go too far in at the free side, and it is

necessary to fix a small slip of wood on either end of the hutch inside to form a stop. This attended to, we next turn our attention to providing latches of some sort to keep the doors shut. Cast-iron swivel latches may be purchased for a penny each, and require but to have a screw inserted for them to turn upon. If these cannot be obtained conveniently, serviceable fastenings may be made of small pieces of hard

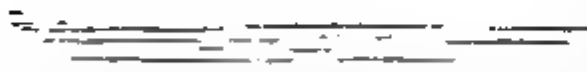


Fig. 19.—RABBIT HUTCH.

wood, of a shape familiar to everybody. In some cases it may be necessary to make provision against thieves, and that can be done by furnishing the hutch with a hasp and padlock. A piece of old tarpaulin or indiarubber cloth nailed over the top of the hutch is desirable as a protection against wet, and having put that on, our work is complete and the hutch ready for its tenants.

HOW TO MAKE BACKS FOR DISPLAYING GEOLOGICAL SPECIMENS, ETC.

In these days boys form collections of geological specimens, butterflies, and the like, and as much of the interest of this occupation depends on having means of exhibiting and preserving the samples, we shall now instruct our pupil how to make shelves and cases in which to display his spoils. For geological specimens which do not require to be specially protected from dust, one of the best arrangements is to have one or two sets of hanging shelves, and these may be readily fashioned with such appliances as our pupil already possesses. We

must begin by preparing two pieces of nice clean pine twenty-five inches in length, three inches in breadth, and half an inch in thickness. These are to form the sides of one set of shelves. Two pieces of the same breadth and thickness, but only nine inches in length, will be required for the top and bottom. Having planed each piece to an equal thickness, and squared their edges and ends, we must now cut in the side pieces a series of grooves in which to fix the shelves. For the purpose of better exposing their contents to view, we propose to fix the shelves in a sloping position. Five shelves will be required, and suitable material for these will be found in some old cigar-boxes, which form a useful portion of our store of timber. The sides of the boxes are already of the thickness we require, and we have but to cut them to a uniform length of nine inches and a quarter, and adjust their width to our requirements. In cutting the grooves we must first divide the sides lengthwise into five equal portions with the aid of a foot rule. Beginning at what is to be the lower end, we measure off three inches and seven-eighths, and there make a mark with a chisel or knife. Another mark one-eighth of an inch beyond this will indicate the limits to be occupied by one shelf, each shelf being one-eighth of an inch in thickness. In this way we

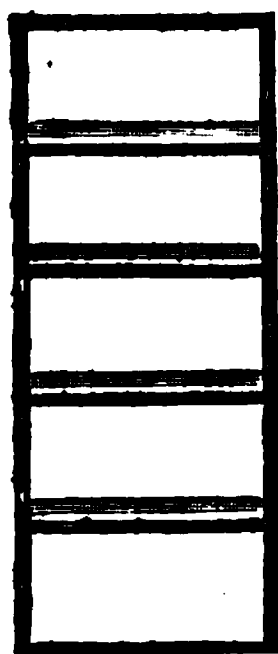


Fig. 20.—RACK
FOR GEOLOGI-
CAL SPECI-
MENS, ETC.

proceed until we have defined the position of each shelf along what is to be the front edge of each side piece. As we intend that the shelves shall be one inch higher at the back than at the front, we measure and mark the back edge of each side piece at points an inch higher than the corresponding marks on the front edge. With a rule and pencil or bodkin we draw lines across the wood connecting the respective sets of marks. This done, we take the tenon-saw and make a cut one-eighth of an inch deep on every line we have drawn. Our smallest chisel now comes into requisition, and with it we chip out the narrow strip of wood left between the saw-cuts, and so complete the grooves. The frame of the shelves must now be put together. There are various modes in which the sides and ends might be united, but we adopt the simplest, and fix the ends in by driving nails into them through the extremities of the side pieces, having first bored holes through the latter with a bradawl. In work of this kind it is necessary to adjust the pieces exactly before entering the nails, and to take care that the nails get into the centre of the end wood, else we may split it, and so spoil our job.

All is now ready for the insertion of the shelves, and if these have been brought to the size mentioned, they should slip easily into their places. Let us try. There they are all right. What is next to be done? Our pupil will readily discover that if it be attempted to put anything on the shelves as they now are, it would at once tumble off. We must provide each shelf with a ledge. Ledges half an inch in depth will suffice, and no better material can be desired for them than such as the shelves have been made of. Let us cut half-a-dozen slips, trim them by planing their edges and taking off the outside angles. A brass nail with an ornamental head driven into each end of each ledge-piece will give them sufficient support, and improve the appearance of our work. If the entire structure be now stained and varnished, it will present an excellent appearance, and may be worthy of a place in any morning-room, study, or library (Fig. 20).

As staining and varnishing are operations which will frequently engage the attention of the amateur joiner, we may here describe how they are performed. Stains of various colours may be purchased ready for use at any oil and colour shop. For our present purpose red or brown will be equally suitable. Should the stain be too thick, it may be reduced by the addition of water. It is applied to

the wood with a piece of sponge. By a little ingenuity, an appearance of graining may be given with the stain. If the first coating of stain should not make the wood dark enough, a second or any number of coats may be applied until the desired effect is produced; but the surface must be allowed to dry thoroughly after each coat is put on. As the stain is but a water-colour, it has to be fixed, and this is done by sizing. Size is simply a thin glue, and it is applied with an ordinary paint-brush. When it has dried, the varnish, which may also be purchased at the colourman's, is put on. For varnishing it is best to use a rather large hog's-hair brush. As new brushes are frequently slack and leave hairs on the work, it is advisable to steep the brush in water before using. It will not, however, do to put the brush into the varnish while it is wet, and it is necessary to shake out as much of the moisture as possible, and then put the brush near the fire for some time. The tips of the hair will thus be dried, while the swollen condition of the upper extremities will cause them to be firmly held by the cord. Our specimen shelves, having been treated in this way, are now ready to be hung, and all that is necessary to admit of that being done is to drive a couple of stout nails into the wall, and place the under-side of the upper end of the case upon them.

HOW TO MAKE CASES FOR PRESERVING BUTTERFLIES, ETC.

Cases for preserving butterflies and moths are furnished with glass covers, and may be made in this way:—Cut out and dress four pieces of wood, each a foot in length, two inches in breadth, and a quarter of an inch in thickness. Nail them together neatly to form the sides of the case. That done, a bottom composed of one or more pieces of quarter-inch deal is to be put on and planed evenly round the edges. At a further stage of our lessons we shall be able to propose a more artistic mode of joining the corners and inserting the bottom; but very serviceable cases may be made in the way we have indicated. The lid is our next consideration. As we have said, that must be of glass, and it may be mounted in a variety of ways. The simplest method is the one we choose at present. Having prepared four slips of wood half an inch in width and one-eighth of an inch in thickness, we nail them round the outer edge of the sides of the case, letting them project above the rim to the extent of one-eighth of an inch. If we now have a piece of stout window-glass cut to fit inside the lip thus formed, we have virtually completed the work. The interior of the case should be covered with white paper pasted on, and the outside may be stained and varnished. Once the objects in the case are arranged to satisfaction, it is desirable to keep them excluded from dust, and to disturb them as little as possible. The most effective manner of protecting them is to paste a slip of stout brown paper along the edge of the glass, so as to overlap the wood rim. If this be neatly done, the case will have a very presentable appearance.

HOW TO MAKE PICTURE FRAMES.

Our pupil may now be taught how to make a picture frame. Mouldings for this purpose in endless variety may be purchased ready-made, and all that is necessary is to cut them to the required dimensions, mitre the ends, and put the pieces together. But though we thus talk lightly of the work, it introduces the pupil to new appliances, and to a series of operations with which he has not yet been made acquainted. He will have observed that in a picture frame of the ordinary kind the corners are brought together at an angle of forty-five degrees, and that by such an arrangement the form of the moulding is carried continuously round the frame. A junction of this kind is said to be "mitred," and special implements are required for its formation. When mitre work in any quantity is

to be done, it is best to get a sawing block. This is a stout piece of board a foot in length, having two pieces about an inch square fixed in a parallel position on its upper side. The parallel pieces have a saw-cut across them on the line of the required angle, so that when the mould is placed on the block, the recess between them, and the saw work referred to, the ends of the pieces to form the frame are reduced to the shape desired. The mitres have next to be planed, and so made ready for being glued. Here the mitre-board comes into requisition. It is a small plank with a three-cornered piece nailed to its upper surface, and its form and the manner of using it are shown in Fig. 21.

Having prepared all the pieces and carefully tested their lengths—for if the respective side and end pairs vary in this respect a satisfactory result will be impossible—we proceed to unite them into the form of a frame. But here we must give some attention to our glue-pot. So far we have got along without this valuable friend of the joiner and cabinet-maker. It consists of two vessels—an outside one to contain the water and an inside one for the glue. As we obtain the glue at the oilman's it is very hard and refractory. The best mode of treating it is to steep it overnight in water. This will be found to have softened it and caused it to swell considerably. We now put it into the pot, first taking care to partly fill the outer vessel with water. In the course of an hour or so, if the water be kept boiling, the glue, which has meantime been stirred frequently, will be ready for use. A stiff hog's-hair brush about half an inch in diameter will be required to spread the glue on the surfaces which it is desired to unite. While our glue is melting we have some other matters to attend to. We must make four small blocks of wood to place on the corners of the frame and take the pressure of the temporary binding cord, in the manner shown in Fig. 22. We must also have five or six yards of twine handy.



Fig. 22 — PICTURE FRAME IN BLOCKS AND STRING.

All being ready, we arrange the pieces of moulding on the bench in the order in which they are to be united. Then we open up and give to the part to be joined a coating of glue. The glue must not be laid on too thickly, but care must be taken to cover the entire mitred surface of each piece. The whole operation must be smartly got through, as the glue is apt to cool rapidly when brought into contact with the wood. As the respective pieces are glued the joints must be pressed together with the hand so as to bring them into close contact. All the joints having been glued and pressed together the corner blocks are applied, and the string quickly wound round them. No matter how well the twine may be strained as it is put on, it will be found to admit of further tightening, and this may be done by inserting pieces of wood at the middle distances, and so increasing the tension. The tendency of the pressure is to bring the frame to lie exactly square, but it is well to apply the square and test the work at this stage, when, should any deviation be found, it may be readily remedied by pressure with the hands. The frame must now be put aside and left undisturbed until the glue dries which will be in seven or eight

hours. We may then remove the string and blocks and examine the joints. If all be sound, we scrape or chip off the superfluous glue with a chisel. It is desirable in most cases to supplement the adhesiveness of the glue by making a saw-cut in the outside of each corner, and gluing into the slit thus formed a thin slip of hard wood. This binds both pieces at each corner more securely, and lessens the chance of a breakdown should the frame be hung against a damp wall.

Now a word as to putting a picture into the frame. Of course the style of moulding will have to be chosen with regard to the kind of picture it is designed for. Let us suppose that the frame we have on hand is made of a slight gilt moulding, and that it is intended for a steel engraving with a wide margin. It is the simplest kind of picture to deal with. In order to keep the engraving well stretched and flat against the glass, we must provide a stretching frame. This is made of thin fir laths, an inch in breadth and a quarter of an inch in thickness. It must be made to fit into the rebate or groove of the frame, and the making of it will be a simple task after the lessons we have had. Its corners may be joined in the same way as those of the doors of the rabbit hutch. When it is completed we must make some paste, and paste the engraving on it in such a manner that the latter shall be kept firmly stretched. This done, we obtain and insert in the frame a piece of glass of the exact dimensions of its rear opening, taking care to select glass free from flaws, and to clean it thoroughly before putting it into position. The engraving on its stretching-frame is laid on the top of the glass and held firmly against it by several tacks driven into the frame from the inside, so that their projecting parts shall press against the stretching-frame. A piece of stout pasteboard or thin slab of wood is fitted above the stretching-frame; and over that, and reaching to the extremities of the frame, a piece of strong brown paper must be pasted. A couple of screw rings by which to hang the picture may now be fixed in the frame, and, that done, our job is finished.

HOW TO MAKE RUSTIC WORK.

Rustic work forms an interesting branch of joinery, and by way of varying our lessons we shall here introduce it to the notice of our pupil. It is easy for boys living in the country near woods to obtain the materials for this kind of work. Gnarled and crooked twigs of oak and other trees are necessary for the effective construction of some articles; but a variety of useful work may be fashioned from the straight branches of the fir. It is desirable that they should be gathered some time before being required, in order that they may become seasoned, and so lose their liability to shrink and change their form.

Before attempting to make any article entirely of rustic work, we shall try to apply it by way of decoration. Here is a window-box for flowers, made of plain deal; let us see what we can do to make it more sightly. We have at hand an abundant supply of dried fir branches. But before we proceed farther we must prepare our design, which may be drawn in bold lines with a carpenter's pencil on the box. Our object is to give our box, which measures four feet in length and nine inches in depth, a front similar to that shown in the engraving (Fig. 23). We first divide the box longitudinally into five equal portions, and mark them off for treatment as panels. Then we find the centres for the diagonal spaces, and similarly set them down. Selecting a fir branch an inch and a half in diameter.



Fig. 23. RUSTIC WINDOW-BOX.

we cut off two portions ten inches in length, and divide them longitudinally into equal parts with our ripping saw. The pieces thus obtained have their upper ends cut to a point, and are then nailed upon the front of the box in the position indicated, where they should form a prominent feature of our design. Some narrower pieces are prepared in the same way to form the top and bottom boundaries of the device. These may be an inch or rather less in diameter, and must be cut to fit the spaces between the upright pieces. In no case must the natural state of the bark be interfered with.

For filling in the design we require to split a number of branches half an inch in diameter. These we cut into the lengths required as we proceed. Beginning at the top left-hand corner, say, we fit a small piece neatly into it, taking care to keep the outer edge of it in accord with the diagonal line which we shall have to follow. Piece after piece has thus to be fitted and nailed on until we reach the centre of the top and side of the panel respectively, when we begin to work from another of the corners, and so on. It is desirable to make the pieces fit pretty closely, so as to expose as little as possible of the box beneath; but at the same time we must preserve to some extent the natural irregularity of the material we are employing.

Having covered the entire surface of the front of the box in the way indicated in the engraving, we must select three "burrs," as the excrescences which present themselves on some trees are called, and so adapt these as to form a centre or boss for each of the panels. The selection and fitting of these are matters of very little difficulty. If they be happily chosen the effect of the design will be enhanced. If the box is to project from the window it may be necessary to carry the design round to the ends. Should such be the case the means of doing so will readily suggest themselves. A coat or two of varnish is now all that is necessary to complete the window-box. It will be easy to vary the design on the basis we have given.

HOW TO BUILD A BOWER.

If our pupil lives in the country, and there are a garden and grounds attached to the paternal residence, there are many pieces of out-door carpentry and joinery that he may wish to do. In the garden there is great scope for the exercise of ingenuity in the execution of rustic work. Bowers, summer-houses, and seats come under this category, and there is nothing to hinder an industrious youth who knows how to use his hands from constructing these. To make a bower he must begin by selecting a suitable spot against a wall well exposed to the sun. Extending outward from the wall he must fix a double row of posts two inches in diameter, and five feet high above the ground. These posts may be of any convenient wood, and the bark should be left on. The rows of posts should be four feet apart, and six or eight feet in length, the distance between the posts in each row being twelve inches. The posts should have their lower extremities embedded in pits about two feet in depth, into which stones and earth should be firmly rammed. A rod of somewhat less diameter than the posts has to be tied along each row within six inches of the top, and a piece across each end, and in the middle length. As the bower is to have an arched roof, ash or willow saplings must be procured, and nailed so as to connect the opposing posts in either row. The hoops of a sugar hogshead, where such are procurable, may be used instead of the saplings, and will be more easily managed. They must be nailed to the side posts so as to spring from a point nine or ten inches from their upper extremities. If it be considered too troublesome to make an arched roof a pointed one will do, and this may be readily constructed with small branches such as are used for pea-sticks, arranged as shown in the engraving (Fig. 24). A seat of simple form may be constructed in the inner end. The selection of suitable

creeping plants to cultivate around the bower is the next step; but with that we cannot deal here. Suffice it to say that a well-constructed bower on the lines here laid down makes a pleasant retreat for reading in during the late summer and autumn months, when the creepers which adorn the structure and form a grateful but still airy shade, are approaching to or are in full leaf.

HOW TO BUILD A SUMMER-HOUSE.

The building of a summer-house is a more formidable task; but yet not one from which our pupil need shrink if he has developed some little capacity for the work we desire him to understand. The structure may be either square, octagonal, or circular, and the wood composing it may be either plain or rustic. We prefer the latter. It may be advisable to have assistance in setting up the frame, as the work is heavy; but beyond that stage the pupil may carry the job to completion. As it is desirable to raise the floor somewhat in order to ward off damp, the house should be founded on a base of stout logs arranged to suit the plan of the house. A post for each angle will next have to be prepared, and fixed in the sub-structure by means of tenons and mortices. The upper ends of the posts will be connected by pieces of plank extending from one to the other. A conical roof to be covered with thatch of straw or heather may be made with a few pieces of deal three inches in width and one inch thick, cut to the required angle at the ends, and nailed at the upper extremity to a block of wood sharpened or turned to a point so as to form a spike or finial when the roof is completed, and at the lower end to the boards uniting the heads of the posts. The walls of the house may be formed of fir branches, about an inch and a half in diameter, split into two and nailed diagonally across the space between each pair of posts. One of the spaces will have to be left clear for a doorway, and the upper half of two of the others for windows. The furnishing of the house is a matter which may be left to the taste of the builder; but we should recommend the erection of a rustic seat along the closed part of the structure, and the introduction of a rustic table. For the sake of giving a finished appearance to the interior, a lining of thin boards may be nailed over the exposed surfaces of the split pieces of which the sides are composed. In thatching the roof it would be well to take counsel with some one who understands work of that kind. It would not be possible to describe the mode of procedure here without absorbing more space than can be spared. When the structure is completed two or three coats of varnish should be applied externally and internally, and it would be an improvement to darken the lining by staining before applying the varnish.

It will be easy for our pupil, after going through the course of training we have sketched, to make rustic fences for garden plots, and also gates and stiles. He may, too, by making a judicious selection of young branches of oak or thorn, build up flower and fern stands. The branches should be gathered green, and then peeled and stored away to dry thoroughly before being fitted to their purposes. Oak and thorn are mentioned because their branches are naturally crooked, and so admit of being used with better effect than woods of more regular growth; but for some purposes other woods are more effective—for instance, the birch with its silvery bark.

CORK WOOD WORK.

For some time past the bark of the cork tree has been extensively used in rustic work, and it is a very effective material when skilfully employed. Its rock-like appearance fits it admirably for the construction of arches in ferneries,

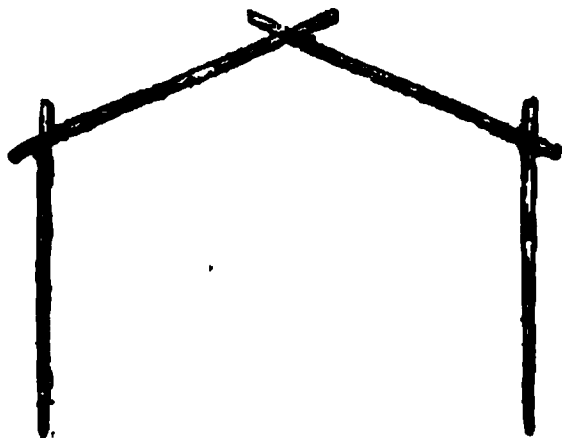


Fig. 24.—FRAMEWORK OF BOWER.

flower vases, window-boxes, and the like. A rustic arch may be built of it, which will form a striking object in a garden. It may be so situated as to form an entrance from one section of the garden to another, or it may simply span the main walk at any point where it would come into view with advantage. In proceeding to build an arch of this kind we must first prepare a skeleton. The pillars on either side should be nine or ten inches in diameter, and formed of slips of deal an inch square, arranged round and nailed to circular pieces of board at the top and bottom. The semicircular or gothic arch should be built in the same way, and attached to the tops of the pillars. When the skeleton is complete, the cork bark is applied in pieces of various dimensions, but not larger than twelve inches by six inches. These are attached by nailing to the spars, so as to completely conceal the latter, and yet display no order of arrangement, the idea being to build up a structure resembling the gnarled trunk of an old tree. At intervals, according to fancy, pockets of the bark may be formed, in which in due season plants of various kinds may be cultivated. At the junction of the arch with the pillars pedestals may be constructed, in which pots containing trailing plants may be concealed.

WOOD CARVING.

AFTER the spell of heavy work he has had, our pupil will, no doubt, desire a change of occupation. Sympathising with his wishes, we will now see what he can do, or be taught to do, in what we may call artistic work in wood. No doubt he has from a very early age possessed a pocket-knife, and if it has been a habit with him to employ that knife in giving fanciful shapes to twigs or chips of wood, we shall have all the more hope of his benefiting by the hints we are now to give. The taste for ornamenting articles of wood by carving—sometimes in a very crude manner, it is true—is universal, and seems to have belonged to all ages. In proof of this we have only to point to the collections of utensils and weapons to be found in every museum. Before civilisation reached the shores of the South Sea Islands, the cannibal natives delighted to adorn their war-clubs and appliances of the chase with notches and grooves, which had a rather pleasing effect, and the Eskimo still spend much of their long nights in the embellishment by similar methods of their paddles and fishing gear. The cultivation of this all-prevailing instinct for wood carving, and the application to it of certain canons of art, have resulted in the production of many articles which grace the homes of civilisation.

HOW TO MAKE A PAPER-KNIFE.

Here we must again utter a word of caution against too ambitious attempts at the outset of our lessons. Let us begin by making a paper-knife. That will at once illustrate the use of some of the carving tools, and the necessity for making a judicious selection of wood. The wood of the lime, the pine, the cedar, the white holly, and the pear-tree is, perhaps, the best suited for such work as the amateur is likely to undertake. The tools required consist of chisels, gouges, and files of a special form, and may be purchased in sets. A useful set for a beginner need not comprise more than a dozen articles, and may be purchased of or through any dealer in tools. Sometimes they are kept in stock by stationers. Here is a nice even-grained piece of cedar that will do for our present purpose. It is an inch in breadth, a quarter of an inch in thickness, and ten inches in length. We shall allow six inches for the blade, and fashion a handle of the remainder. We begin by thinning the wood, by planing from the part where the handle is to begin towards the point, as this may be done most conveniently at this stage. An outline of the blade and handle is next carefully drawn on the wood with a pencil. Laying the wood flat upon a piece of smooth deal, we shape the handle

according to the outline by using a chisel and cutting perpendicularly along the edge of the wood until the desired form is imparted to it. The design for the carving with which the handle is to be ornamented may now be copied from the paper on which, we presume, it has been sketched. The simpler the design the better. Suppose we content ourselves in this instance with a flat rim an eighth of an inch in width, following the outline of the handle, and enclosing three lozenges with rounded surfaces rising from a "matted" or roughened ground (Fig. 25).

The next operation is to "cut in" the lines. This is done either with a knife or the corner of a chisel. A depth of about one-sixteenth of an inch will suffice. Having completed the outlines, we proceed to remove the wood between the lozenges and the rim, using for this a tiny chisel of special form. An important point to observe in cutting sunk surfaces is to preserve them even. The lozenges being now isolated, we may round their surfaces by paring. The swell or bar which marks the junction of the handle with the blade may now be brought to shape. Following the idea of the rim on the handle, it may be cut square and flat, or it may be relieved by a slight groove along its centre.

The blade now claims attention. We have already thinned it somewhat towards the point, but the thinning process must be continued towards the handle. The plane, for obvious reasons, cannot be brought to bear upon it, and we use a chisel or knife. But we first bring the blade to the shape, by paring it upon a piece of board, as we did the handle. Operating first on one of its flat sides and then on the other, we thin it away towards the edges, and give it the usual form. To complete the work thus begun with the chisel we use a file, which is an important tool in the wood-carver's stock. With the file we can bring the blade to a perfect form, and leave little to be done in the way of finishing except a rub with a piece of fine glass paper. On completing the blade we return to the handle, and give a few finishing touches to the outline, &c. The sunk ground from which the lozenges rise is then matted by punching it all over with a blunt bradawl. A coat of fine varnish may be added if desired, but if the work has so far been carefully done, it will look better plain.

Fig. 25.—
HANDLE
OF PAPER
KNIFE.

HOW TO MAKE A MIRROR FRAME.

A more difficult task may now be undertaken. Here is a pretty, but simple, design for an oval mirror frame (Fig. 26). Let us try to make it. We require a piece of wood that shall be at once strong across the grain and easily carved. A piece of white holly will answer our purpose admirably. Our mirror is not to be of large dimensions, and we shall be able to fashion it out of the solid very nicely. A piece of the wood named measuring eight inches in length and six inches in width will do, and it need not be more than half an inch thick. We begin by drawing lines on the wood describing the form and dimensions of the frame, which is to measure an inch in breadth, then boring a hole at any point near the inner line, we, by means of our compass-saw, cut out an oval piece from the centre. We next round the corners with the compass-saw. In cutting both inside and outside we leave a safe margin, to admit of any irregularity being rectified.

Fig. 26.—MIRROR FRAME.

A tool not yet mentioned is now required. This is the spokeshave (Fig. 27), a most useful implement. It is virtually a plane, but so constructed that it is



Fig. 27.—SPOKESHAVE.

capable of smoothing both the inside and outside of round or oval forms. With it we remove the superfluous wood from both the inside and the outside of the frame; and by its aid, also, we bevel the front surface so

as to reduce the thickness of the outer edge to a quarter of an inch. But before the latter operation is performed it is necessary to cut round the rim of the aperture on the rear side a groove, to hold the plate of the mirror and its backing. That done, the design may be drawn on the wood. It consists of a single wreath of small ivy-leaves arranged on a matted ground, and bordered on each side by a beading.

We proceed, as before, by cutting along the outlines of the leaves and stalks, and also the bounds of the beading. Then we cut away the intervening wood to the depth of a sixteenth of an inch, or rather more. The stems are rounded and the surfaces of the leaves hollowed slightly, so as to obtain a shading suggestive of the natural form. It is not desirable to make the stalks smooth; indeed, a little roughness of treatment will enhance their effect. Having matted the sunk ground, we complete the work by dyeing the frame black, and so "ebonising" it.

A suitable stain or dye for ebonising wood is composed as follows, though smaller proportions may, of course, be used:—Strong vinegar, one gallon; extract of logwood, two pounds; green copperas, half a pound; china blue, quarter of a pound; nut galls, two ounces. Boil in an iron pot over a slow fire; when cool the mixture is ready for use. Add to the above half a pint of iron rust, prepared by steeping iron filings in strong vinegar.

HOW TO MAKE A BOOK RACK.

This simple piece of furniture is quite within the powers of execution of the pupil who has accompanied us to this point. It may be made of mahogany, oak, or walnut. We shall select oak. The base should measure fifteen inches in length, six inches in width, and five-eighths of an inch in thickness. It should be planed smooth, and neatly squared on the ends and edges. For the ends we require two pieces six inches in length, and of the same width and thickness as the base. As the latter is out of sight when the rack is in use, we do not require to embellish it in any way. The ends admit of a variety of form and treatment. Suppose we adopt a design something like that shown in Fig. 28.

Our first business must be to draw the design on a piece of thin paper. It may be traced from a book or print if desired. When the tracing is completed we lay it face downward on the bench and cover the back of it with powdered red chalk. The piece of wood to form one of the ends of the rack is next taken and treated to a slight coat of whiting. The tracing is then laid upon the wood with the red side undermost. With a blunt bodkin or lead pencil we now draw firmly along all the lines, and by this means reproduce the tracing on the surface of the oak. Having accomplished this, we remove the paper, and with pen and ink make a complete drawing of the design on the wood. For convenience of carving we now fix the piece of oak to a plank, so as to steady it. A screw passed through each of the superfluous corners of the wood will suffice to secure it. The first



Fig. 28.—END OF BOOK RACK.

thing to be done in the way of cutting is to "stab out" the work. This is done by cutting the outlines with one of the smaller chisels, not in the first case running the chisel along, but holding it in an upright position and pressing it downward to about the depth of one-sixteenth of an inch. It is advisable not to cut exactly in the ink lines, but to keep just outside of them. When the stabbing is done we hold the chisel in a slanting position and cut towards the pattern, making a well-defined line to guide us in cutting out the wood from the sunk part of our device. For the removal of this wood the gouge is the tool required. It must be worked across the grain of the wood, and be held firmly, so as not to mutilate the raised part of the carving.

Having cleared the ground, we proceed to develop the stems, leaves, and berries; and here the effect produced will much depend upon the taste and judgment of the carver. By graduating the height and slightly curving the surfaces of the leaves, a considerable effect of light and shade may be secured. When the carving is complete, we detach the work from the plank to which it has been screwed, and with the compass-saw shape the corners, finishing them with the chisel and file. The finger-hole is now bored out and shaped, and when that is done we may proceed to attach the ends to the base by means of brass hinges.

It is not desirable either to varnish or French polish oak. The wood shows at its best when simply coated with oil and well rubbed. If it be desired to darken the oak, that may be done by the application of burnt umber mixed with oil. The oil should be applied with a piece of flannel, and allowed to soak in, after which the surface should be vigorously rubbed with a hard brush. A final polishing with a small roll of flannel will bring the wood to the required condition.

FRET-WORK.

THIS has always been a favourite branch of wood-working with amateurs, and affords wide scope for the exercise of artistic skill. The beautifully minute and exact work to be seen in the fronts of pianos and on various articles of ornamental furniture rarely fails to excite admiration of the skill by which it has been produced. Fret-cutting is, indeed, a distinct occupation, and is a high branch of art workmanship. It is one of those occupations, too, in which, after a few preliminary lessons, any person who is possessed of some artistic taste and neatness of manipulation may make considerable progress. The implements required are few and simple, consisting mainly of a fine gimlet and a saw or two of peculiar form.

The object of the fret-cutter is to give an ornamental appearance to wood by piercing it according to a given pattern. The Chinese are experts at the work, as may be seen in the fans and models which they fashion in ivory, mother-of-pearl, &c. We shall not attempt to imitate the laboriously minute and lace-like work of the Asiatics, but content ourselves with the execution of a few simple devices of an initiatory character.

HOW TO MAKE A CARD TRAY.

Let us make a card-tray to begin with. Here are a few pieces of cedar cigar-box. The wood is just of the thickness we require, so we may proceed at once by drawing our design upon it. The tray is to be octagonal in form, so that to form its sides we require eight pieces. To these we must give somewhat of a wedge form, as in the drawing (Fig. 29), so that they shall measure on the long edge three inches and a quarter, and on the short edge two inches. In the first instance we do not cut them out so, because we can more easily use our fret-saw before

reducing the original dimensions of the wood. The only preliminary operation required is to plane the edges even, and bring the width down to two inches.

Having drawn our design upon paper, and transferred it to the wood in the manner already described (see p. 596), we begin by boring a hole with the gimlet close to but within the lines bounding one portion of our device. We have now reached the interesting point where our saw comes into requisition, and here we must say a word or two about that tool. It consists of a bow of metal, and altogether may be compared in form to the letter P. The bow and the lower part of the straight limb are in one piece, the latter forming the handle, and the upper portion of the straight limb represents the saw. The saw, for purposes such as ours on the present occasion, is exceedingly fine, being simply a piece of square steel wire, with teeth cut on one of its sides. It is fixed to either tip of the bow by screws, and there is a screw arrangement, at the outer tip by which the saw may be drawn and held taut. The teeth of the saw may be turned in any direction in relation to the bow, and this arrangement is of great use, as our pupil will readily discover. But we must proceed. Undoing one end of the saw, we

pass it through the gimlet-hole, and then secure it again. Having taken care to draw the saw straight by means of the screw, we may now work it to and fro along the lines of the design. The portion of wood to be cut out is a small one, and it is speedily disposed of. The saw is then undone at one end, withdrawn, and inserted in a hole made in another part of the device; and so on, until the whole is cut. While being operated upon, the wood may be held in the lug of the bench.

Fig. 29. - SECTION OF CARD-TRAY.

In designing fret-work great care must be taken to leave connections, which, while not interfering with the idea of the device, will give strength to the work. In cutting, it is necessary to move the saw exactly at right angles to the wood, so as to leave a square sharp surface in the incisions, as these cannot be dressed afterwards in any way, at least not without marring the effect of the design.

All the side pieces having been prepared and brought to the desired outline, our next care is to provide a bottom for the tray. This will require a piece of wood measuring about five inches square. It may be either plain or ornamented, with a fret-work device harmonising with that of the sides. If we prefer the latter, we proceed as before—transferring the design, boring, and sawing in succession. As the bottom will project from beneath the sides a little way, its edges had better be rounded.

A somewhat difficult job is now before us, namely, the putting together of the various parts. The side pieces have to be mitred to the required angle at the ends—that is, planed so that the ends shall meet closely when the pieces are arranged in their final position. Their upper edges may be rounded now, and the lower ones planed to an angle to fit closely to the bottom. On the care with which all this is done will largely depend the strength of the tray when finished. For the purpose of putting the pieces together we require to prepare a block of particular construction to hold them in position while the glue is drying. We proceed by drawing on a piece of deal lines corresponding to the inner lip of the tray. On each side of the octagon thus formed, and just within the line, we fix by gluing a piece of fir about an inch cube, and having its outer side shaped to the slope of the

sides of the tray. Against these blocks alternately we place one of the side pieces of the tray, with its longest edge undermost. To secure the pieces in that position we shape a second block for each piece and screw it down to the deal. Having our glue handy, we coat one end, each of two pieces in the blocks, and both ends of the piece which we hold in our hands. The latter we then insert between the others, and secure it by attaching the block which belongs to it. The three pieces are thus held firmly together. We proceed in the same manner with the other joints, and having completed the fixing of these, we run a coat of glue on the exposed edges of the pieces and lay on the bottom, placing a weight upon it to hold it down firmly and make a good joining. When the glue has thoroughly dried we remove the outer blocks and lift off the tray. A coat of stain and varnish will complete our work. The operations necessary to the construction of this article are applicable to a number of others, which will readily suggest themselves to the enterprising student.

HOW TO MAKE A WALL BRACKET.

Brackets for the support of statuettes or vases are now common ornaments in every house, and possibly our pupil may desire to try his hand at making one. He already possesses all the tools necessary, and has had some practice in the kinds of work required, so that he will need very little help from us. Having determined on a design, he must obtain a piece of white holly large enough to make the back portion. This may be, say, from eight to ten inches in length by seven in width, and three-eighths of an inch thick. The design is a combination of scrolls in fret-work and carving, and the first thing to do is to place the design on the wood in the manner already described, the second to saw out the open spaces, and the third to shape the parts with the carving tools. The shelf is a plain piece, which may be either semicircular in form or scalloped along the front, and its support must be of open work, in harmony with the style of the back (Fig. 30). Sometimes the parts are hinged for convenience of packing, but when such a provision is not required they should be glued, and subsequently nailed together. The wood may be blackened in the same way as the mirror frame which we have already made.

Fig. 30.—WALL BRACKET.

WOOD-TURNING.

THE highest ambition of most amateur mechanics is to possess and be able to work a lathe. Turning is a very fascinating recreation, and many men of eminence have given a portion of their leisure to it. There is endless scope for the exercise of taste and skill in turning, and in its higher departments the art is almost elevated into a science. The difference between turning and those branches of wood-working which we have already dealt with is this: that whereas in the latter the material is held firm and the tools are moved about over it, in the former the material is made to rotate and the tools are moved only to a slight extent. As a block of wood is steadily rotated in the lathe, it may, by the application of gouges and chisels, have a graceful or elaborate outline imparted to it, according to

the fancy of the turner, and the cylindrical form of the work is infallibly true. There are many kinds of lathe now in use, each adapted to a certain variety of work, and some of those used by engineers and scientific instrument makers are very complicated and exact pieces of mechanism, capable of turning articles of almost any shape.

In its primitive form the lathe is a very simple machine, and is still to be seen in use, not only in the shops of many village carpenters, but in cabinet factories, being used in the latter case for dealing with spiral turnings, such as chair legs and mirror pillars. As the construction of this simplest kind of lathe is within the capacity of an amateur, we will briefly describe it. The first requirement of a lathe is to be equal to giving a rotary motion to a piece of wood. Now, if the piece of wood, say such a piece as the fore leg of a chair may be made of, be held horizontally between the tips of the forefingers, the fingers being pressed inward against the centre of each end, and the wood be brought into contact with one's knee, and at the same time pushed forward, it will, by the friction on its sides, be made to rotate round the centre indicated by the finger-tips. Here we have the idea of support between two points and motion round a fixed centre. These ideas we must translate into actual mechanism.

Let us construct a stout frame of wood, and erect on it a pair of iron points to take the place of our fingers in the illustration just given. What we are aiming at is shown in Fig. 31. The upper part of the frame consists of two parallel beams, with a little space between them. The parts which stand up at each end are called the "head-stocks." One of these, that on the right hand, is movable, and may be fixed at any point between the bars by means of a wedge or screw. Through the left head-stock a stout iron screw is passed from the outside until its tip, which must be filed to a smooth conical form, projects about half an inch.

The movable head-stock is also furnished with a screw, but it is so arranged as to be adjustable. The tips of the two screws must be exactly opposite each other.

Our next step is to procure a piece of fir, say about a foot in length and two inches square. With the chisel we chip off the corners and reduce the wood to an octagonal form. A small portion at one end is at the same time rounded with the chisel, for reasons which will become manifest shortly. Having found by compass or other mode of measurement the central point in each end of the wood, we mount the wood in the lathe, if we may so call our creation at this stage, and by turning the screw in the right hand head-stock, hold it firmly suspended between the points or "centres."

As yet we have made no provision for imparting motion to the wood and that must be our next care.

If we take a piece of cord and put a couple of turns of it on the rounded portion of the wood, we may, by holding an end of the cord in either hand,

Fig. 31.—SPRING LATHE.

and drawing it to and fro, make the wood revolve backward and forward alternately. We must, however, provide for the production of this motion by some means that will leave our hands free to guide the tools. To the roof of the workshop we fix a stout lath of ash or yew by one of its ends, so that its other end shall be free to yield to a downward pull—to serve the purpose of a spring, in fact. To the free extremity of this lath, which should be directly over the left end of our lathe, we attach one end of a stout cord which we lead downward and

twist two or three times round the wood held by the centres, just as we did in the case of the experiment by hand. The lower end of the cord is next attached to the free end of a treadle, composed of a piece of deal hinged to the floor at one end by a piece of leather strap. The length of the cord is so adjusted that when the treadle is pressed close to the floor the upper lath bends downwards for the distance of a foot or so. If we take the pressure off the treadle now we shall see that the overhead lath will recover its position, and in doing so draw up the cord, which will in turn cause the wood in the lathe to revolve and the treadle to rise. With this upward motion the wood revolves away from us. We now place a foot upon the treadle and press it down. This causes the wood to revolve towards us; and if we present a gouge to it shavings will fly off. The advantage of getting the forward motion by the pressure of the foot is that any degree of force may be applied, and all the work imposed upon the overhead lath is to draw back the cord for each fresh effort.

But our lathe is not yet complete. If we attempt to hold the tool steadily against the wood we shall fail, and a tool-rest has to be provided. This is an adjustable piece of iron attached to the front beam of the frame, and presenting a straight upper edge about four inches in length. By resting the cutting tools on this they may be perfectly controlled, and accuracy of work ensured. Having made this provision, we now possess a lathe of the earliest type, on which a variety of work may be done.

As it is probable, however, that those we are addressing will prefer to purchase a more perfect machine rather than attempt to make one of the kind described, we shall not linger longer over the old-fashioned article. In the march of

Fig. 32.—LATHE.

mechanical improvement it was evident that the spring lathe, which had proved itself so useful, should not be left behind, and the furnishing of it with a crank and fly-wheel, besides the making of most of its parts of metal, came as matters of course. Even in this improved form the lathe is a very simple piece of mechanism, that is, as used for most ordinary purposes. We do not intend to deal with its adaptation to the requirements of the mechanical engineer, but simply to explain its uses to our pupil, and give him such hints as may enable him, if he will but persevere, to produce a variety of articles of use and of ornament.

Here is a figure of the lathe on which we shall begin our lesson (Fig. 32). It will be noted that though not composed of many parts, it is a higher mechanical creation than the one we have already described. Perhaps a less substantial and consequently less costly machine might suit our present purpose; but we have in view the fact that in a little time we shall have to practise working in metals to some extent. For wood turning simply, a lathe with a wooden frame would be sufficient, but in dealing with metals we must have a more stable structure, as good work can be got only by great steadiness in the machine. The frame of the lathe before us, then, is composed of cast-iron, and consists of two end

pieces, or standards, supporting the parallel horizontal beams, which are known as "the bed." On the left-hand end of the bed the head-stock is fixed. It supports an axle, or mandril, furnished with a conical grooved pulley. One end of the mandril passes through and projects from the face of the right-hand end of the head-stock, and the other end rests in bearings.

At the right-hand end of the bed is the movable head-stock with its adjusting screws. In a central position the tool-rest is shown. The driving-gear of the machine is situated in the lower part. First, we have a fly-wheel with grooves arranged conically. It is mounted on an axle with a crank formed on it. Then beneath the axle we have the treadle, the mountings of which are clearly shown in the engraving. The treadle and crank are connected by a chain-strap, and the fly-wheel transmits its motion to the pulley by means of a driving band.

The object of giving a conical form to the wheel and pulley is to enable the turner to give a faster or slower motion to the lathe—the quick motion being adapted to soft material, and the slow to hard. It is obvious enough how this is accomplished; but yet we may explain it in a few words. If we put the band in the groove on the largest diameter of the fly-wheel and in the smallest groove of the pulley, we shall find that by turning the fly-wheel once we make the pulley revolve twenty times perhaps. Whereas, if we put the band on the narrowest part of the wheel and on the widest part of the pulley, we shall reduce the motion of the latter to four for each revolution of the former.

With the lathe before him, and by the aid of these few explanations, our pupil will have a pretty correct idea of the principles of the machine. Let us now put a piece of wood upon the lathe—say a block of pine about ten inches long and three inches in diameter, the original square form of which has been roughly reduced to an octagon with the chisel or hatchet. We begin by screwing on to the projecting end of the mandril an appliance supplied with the



Fig. 33.—FORK CHUCK.

lathe, and known as a "fork chuck" (Fig. 33). This has some resemblance to a centre-bitt, and its use is to take such a bite of the end of the wood as shall enable it to carry the latter round against the cutting tool. Having found and marked the central point in each end of the wood, we bring one end into contact with the chuck and press it to. Holding it thus we advance the centre-point of the movable head-stock, by turning the wheel which controls it, until the point enters the wood to a sufficient distance to support it. The centre-point has nothing to do with turning the wood round, it merely acts as a pivot.

Before attempting to apply a tool to the wood it is necessary that the pupil should practise driving the lathe, so as to ensure a continuous and steady motion in the direction required. When one observes the ease with which a skilled turner does this, the operation seems a simple one; but an attempt or two will show that the ease can come only by practice. At first the fly-wheel will seem to bound round first in one direction and then in the other, as if it desired to show that it had a will of its own. After the treadle has been pushed down to its utmost the pressure of the foot should be at once eased. Slightly touching the treadle, the foot should then rise with it until it reaches its highest point and begins to descend. The crank has now turned its centre, and by applying pressure we bring it down, and at the same time give sufficient momentum to the fly-wheel to make it carry round the crank until it again reaches the position favourable for pressure. By observing and practising this simple instruction it will become easy to drive the lathe in a very short time.

It is a fancy with some amateur turners to possess every conceivable form of tool, and the makers have been most profuse in their supply. As a matter of fact, however, the tools which it is really necessary to have are remarkably few

in number. A visit to the workshop of any practical wood-turner will prove this. In purchasing a lathe, therefore, our pupil would do well to take with it only such tools as he is likely to require. He will begin his turning lesson on soft wood, such as pine and willow, and if he buy three gouges and three chisels of different sizes, a side tool, and a parting tool, he will be sufficiently stocked. He will observe that the chisels and gouges differ from those he is already possessed of. The chisels are sharpened from both sides, so that their faces are wedge-shaped, or double-bevelled, and instead of the edge being at right angles to the sides it is oblique.

Our first lesson in actual turning will be an endeavour to reduce the piece of wood we have fixed in the lathe to a smooth cylindrical form of equal diameter throughout. We adjust the tool-rest opposite the right hand portion of the wood, and, having already by practice mastered the art of working the treadle, bring our half-inch gouge to act upon the wood. We must take care to advance the tool gradually so that it may not take too big a bite and so, probably, jerk the tool out of our hands. It is always best not to attempt to take off a thick shaving, as doing so not only puts an undue strain upon the hands but tears the surface of the wood. Experience will soon show what depth of cut is best. Having found the point at which the wood comes into contact with the chisel, we advance the latter slightly, and then slide it along the rest toward the left. This operation is repeated until all the angles on the section of the wood, which the length of the tool-rest enables us to command, are reduced. As the rounded point of the gouge leaves the surface marked with a series of annular grooves we must smooth them down by using a chisel, but before doing that it is best to move along the tool-rest and continue the use of the gouge until the entire surface is rounded. Moving the tool-rest back to its first position, we now take the three-quarters turning chisel and apply it to the wood. This gives a perfectly smooth surface.

So far so good; but we must make the diameter of our cylinder uniform, and that requires some care and an amount of skill that practice alone can give. After we have smoothed down the whole surface we shall probably find on measurement that one end is of less diameter than the other, and that the sides will, when a straight-edge is applied to them, show a succession of humps and hollows. To make our work true we must first make a small portion at each end of the cylinder of the desired diameter. This we do by measurement with the callipers (Fig. 34), an instrument with forked points adjustable on a pivot. We apply the callipers first to one end of the cylinder and then to the other, and so ascertain how they stand in relation to each other. Should one be larger than the other we must turn it down to the extent required to produce uniformity. In dealing with the portion of the cylinder lying between the two ends thus adjusted, we depend for guidance upon the straight-edge—which we may explain is a piece of wood or metal with its edges made exactly straight. By placing this on the upper side of the cylinder, and looking towards the light, we shall at once detect any inequalities of surface. As we are but beginners it is possible that before we obtain even an approximately true cylinder we shall have gone over the entire surface of the wood again and again, and so reduced its diameter considerably.

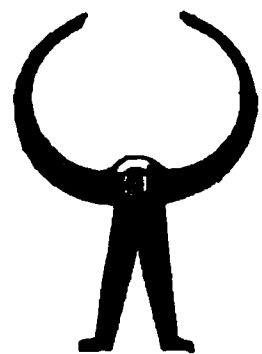


FIG. 34—DOUBLE CALLIPERS.

After we have found a surface to our satisfaction, we may proceed to make hollows, swells, and beads on the wood, using for this purpose the gouge and chisel alternately with others of the tools at our command. The form that the work will take may be left to the fancy of the pupil. Having practised curved outlines for some time, attempts may be made to copy the more familiar

vase forms, first in fir and subsequently in sycamore. Drawer knobs, hat pegs, and other common objects of the household may likewise be undertaken. It should be an object after having made one article to endeavour to produce an exact copy of it. This, after a time, will be found quite easy with the aid of the callipers.

HOW TO MAKE A REEL-STAND.

Our pupil will now desire to make some article that will afford to his friends evidence of his capacity, and we must see him through with it. If he has any aptitude for the work he will be quite able to construct a reel-stand, and an article of that kind, if nicely made, will not fail to win the admiration of the female members of the family. A general idea of the stand we have in view may be derived from the engraving (Fig. 35). It is designed to hold three tiers of reels—four on each tier—and consists of a central pillar and three platforms.

Fig. 35.—REEL-STAND.

The materials we require are several pieces of mahogany—one measuring eight inches in length and one inch in diameter for the pillar, and three flat pieces about three-eighths of an inch thick, and large enough to make three discs of five inches and a half, four inches and a half, and three inches and a half in diameter respectively. Having sketched a design for the pillar, making due provision for ornamentation and for the attachment of the discs, we place the wood for it in the lathe and proceed to reduce it to shape. We first give it the form of a cylinder of equal diameter throughout. We next measure off and mark with the turning chisel the various longitudinal sections of the design. Beginning at what is to be the base of the pillar, we then turn down a portion half an inch in length to the same in diameter. This part is intended for insertion into a hole in the centre of the lower platform. The next stage is two inches in length, and will form the support of the second platform. It is desirable to reduce the diameter of the top and bottom of this section as little as possible, so that it may best support the structure. It may be reduced to an elegant vase-shape, however, without detracting from the diameter of its extremities. A plain piece, three-eighths of an inch in length, is next worked out for the second platform to be fixed upon. Another ornamental part, two inches in length, rises from this; but it must be of less diameter than the portion prepared for the disc, as the latter will have to pass over it when being put into its position.



Fig. 37.—EDGE OF DISC FOR REEL-STAND.

Just over this part provision has to be made for the upper disc. That done, the remainder of the wood may be worked into an ornamental finial. The pillar will now present this outline (Fig. 36), and the extreme measurement of the parts we require is seven inches.

We may now proceed with the discs. With the compasses we strike a line upon each, indicating their extreme dimensions, and then with the compass-saw remove the wood to within a short distance of the outside of the line. Placing one of the pieces in the lathe we turn down its edge to any desired form—say that shown in Fig. 37. To work out the



Fig. 36.—PIVILAR OF REEL-STAND.

beading on the upper edge the tools must be nicely handled. The second disc may have an edge of another form, and the third may differ from the others. There is a plentiful choice of simple mouldings to give ideas for this. Before removing the various pieces from the lathe, they should be smoothed by holding against them as they revolve a piece of fine glass paper, wrapped round either the finger or a piece of cork of suitable form.

Holes have now to be bored in the discs for the pillar to pass through, and also for the pegs which are to hold the reels. The holes have to correspond in size with the portions of the pillar prepared for them, and should be rather a tight fit. The provision for holding the reels in the two lower tiers consists of a peg or spindle dropped through the upper disc and the reel into a hole in the lower disc. The spindles may be made of the same material as the stand, and may be fashioned on the lathe. They should be three-sixteenths of an inch in diameter, and have ball-shaped heads. In the lower disc the holes for the spindles should be almost an inch from the edge, and those in the disc above exactly opposite. The arrangements for the reels in the second tier are to be made in the same way. On the upper disc four pegs for small reels are fixed points upward.

The holes having been bored and the pegs fitted, our next task is to provide four feet for the lower disc. These we may make of ball form by turning. All the parts are now ready to be put together, and we must bring forth our glue kettle. We begin by attaching the feet to the lower disc; and that done, proceed to fix the bar of the pillar into the hole prepared for it in the same disc. We must be careful to coat with glue the part of the pillar that is to rest upon the disc as well as the part fitted to the hole. The shoulder prepared for the second disc is then glued and the disc slipped on. Here we must see that the spindle holes in this disc are brought exactly over those in the one beneath. The upper disc is put into position in the same way.

After the glue has dried we may proceed to give the wood a final smoothing with glass paper, and so prepare it for polishing or varnishing. The work would look brighter and sharper by being polished, but the trouble with an article of this form would be considerable, and we shall varnish it neatly instead.

HOW TO MAKE A MUSIC OR NEWSPAPER RACK.

With the knowledge we have now acquired we may undertake to fashion on the lathe the parts of a variety of useful articles, which will readily suggest themselves. Music or newspaper

racks made in imitation of bamboo work come in happily with any kind of furniture, and it will not be amiss to make one of these the subject of our next lesson. The general form is familiar, but there are many varieties in the arrangement of the details. A convenient design for our present purpose is shown in Fig. 38. Here we have two parallel barred sides, united at their lower edge, and set perpendicularly upon feet formed like the letter X, the lower part being widely set, so as to give stability to the article.

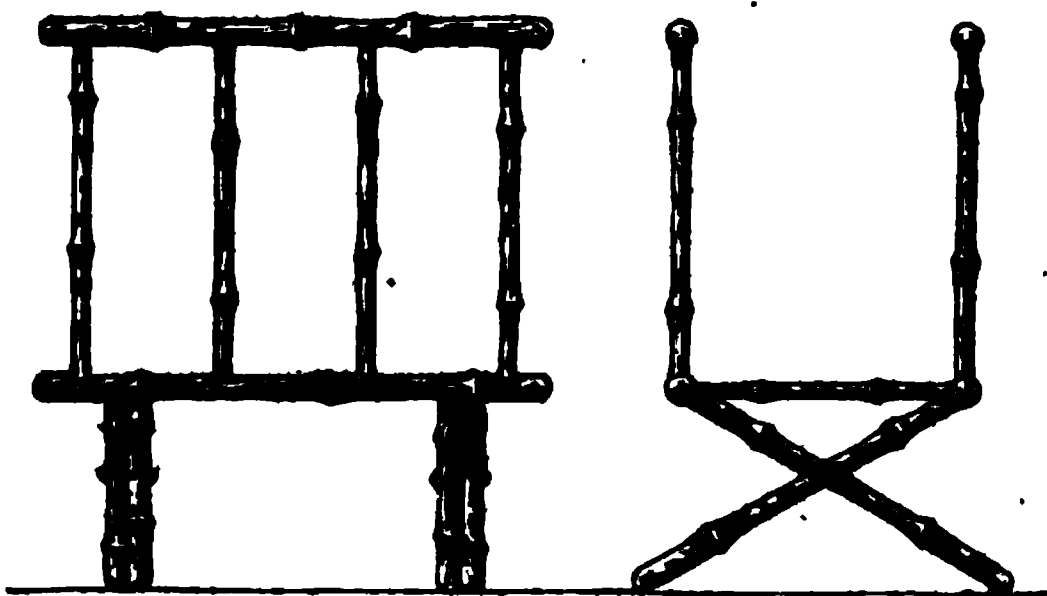


Fig. 38.—NEWSPAPER STAND: SIDE VIEW AND END VIEW.

We may use mahogany, sycamore, or beech, or we may make our essay with pine, but as the chances are that mistakes and accidents will occur to make it necessary to turn fresh parts, if we work in pine the labour of replacing spoiled pieces will be least. Looking at the engraving the rack seems to be an exceedingly simple structure, and yet we shall require to turn twenty-one separate pieces of wood before we can produce it. There are four longitudinal and eight perpendicular pieces in the sides; there are five cross-bars uniting the sides and forming the bottom of the rack, and there are four pieces in the feet or supports. As it is desirable to protect the music from being abraded by the friction of the dresses of the ladies of the house, we must make the ribs a little longer than a sheet of music, suppose we say sixteen inches, and the depth may be twelve inches. The height of the cross-shaped feet added to the latter will make the entire height of the rack eighteen inches.

In giving a bamboo pattern to turned work it is usual to put a larger number of joints in a given length than are seen in the cane itself; and in dealing with the longest pieces we are now to produce, three joints, dividing them into four equal portions, will be a convenient allowance. The extreme diameter of these pieces may be three-quarters of an inch, and that of the feet the same. Half an inch will be sufficient for the upright and bottom spars. We may now proceed to turn the various parts, which we presume have already been brought to approximate dimensions by sawing and planing. It is well to have a few pieces of bamboo before us, not for the purpose of copying them, but merely for giving us an impression. On this occasion we are adaptors of a natural form to the requirements of art, and not copyists. In dealing with the long side pieces there is nothing special to be observed. When we come to the upright spars we have, however, to observe to work both ends down to a plug form, for insertion in the long pieces, for in this way the various parts will have to be united throughout. It is well to allow half an inch at each end for this purpose, though we shall not require quite so much. The effect of these spars will be enhanced if we vary the position of the imitation bamboo joints so that they shall not present a rigid symmetry of arrangement. This may likewise be done in the other parts.

Having completed the turning, we may proceed to put the parts together. We begin by boring holes in the long side pieces or rails, to receive the ends of the upright spars. Fixing the piece to be operated upon in the bench lug, we measure off and mark the position for the holes, and then with our brace and spoon-bitt bore to a depth of half an inch, or slightly more, taking care not to let the bitt go completely through. In boring a succession of holes in work of this kind we must observe to hold the bitt in a perfectly perpendicular position, else when we insert the pieces we shall find that they do not range properly. At right angles to these holes, and in the intervening spaces, we bore holes in what is to be the lower side rail, to receive the bottom spars; and also provide for the insertion of the feet. The holes for the latter take a diagonal direction in relation to the others; but no difficulty presents itself in dealing with them.

If we now insert one of the pieces in the hole prepared for it we shall find that it fits awkwardly, the square section of its shoulder not lying kindly to the rounded side of its neighbour. This must be remedied, and we proceed to a general adjustment of the parts. The shoulders of all the pieces require to have imparted to them a curved form, as in Fig. 39, and the tips may require some paring to adapt them to the depth of the holes prepared to receive them. It will be obvious that all the parts cannot be glued at one operation. We begin with the sides. Laying one of the rails on the bench we coat one tip of one of the spars and insert it, pressing it firmly home. When the four have thus been disposed of, we glue the projecting tips and insert them simultaneously in the

other rail, tapping the latter gently with a mallet to send it into position. A piece of twine wound round the structure will hold the parts together securely until the glue dries, and to ensure that the work shall not be warped or twisted, we lay it on the bench and place a heavy board or weight upon it, testing it at the same time with the square to see whether the spars stand at right angles to the rails. When the sides have dried, which will not be for seven or eight hours, they may be united by the insertion of the cross-spars, and, finally, the feet may be attached. It will give strength to the rack if the feet at the point where they cross be united by a wooden peg. The rack is now ready for staining and varnishing. In applying the stain it will be easy to give a cane-like aspect to the work; but this we leave to the taste of our pupil.



Fig. 39. — JOINT FOR NEWSPAPER STAND.

HOW TO MAKE A PORTABLE WARDROBE.

Another easily made and useful article is that known as a portable wardrobe. This is a set of pegs mounted in a movable frame, which may be hung on a door or in any convenient corner, and which, when not in use, may be folded up and put away in a small space. It may be made of mahogany, beech, or ash, or, indeed, of any wood of moderate hardness and strength. Here is our design (Fig. 40). For its execution we require some rods of wood that will be an inch in diameter when rounded. The extreme length of the frame is thirty inches, and its height eight inches.

We begin by turning down the longer rods to a cylindrical form. As considerable strength will be required to sustain the wardrobe when fully loaded, we cannot afford to cut into the wood much in the way of ornamentation, and must confine ourselves to some shallow beading at the extremities and in the centre. The extremities have to be reduced for insertion into the side pieces. The side pieces have ornamental ends rising above and descending below their junctions with the others. The design of these may be left to the fancy of the turner.

The inside height of the frame is six inches, and bearing that in mind, we set about fashioning the upright pieces which carry the pegs, and are movable to and fro on pivots inserted in the top and bottom rails respectively. Here, as in the frame, we must leave as much wood as possible, giving only the slightest suggestions of ornamentation. Into each of the uprights a long and a short peg are fitted, and to give strength to the structure these are coupled by a small piece inserted an inch behind the point of the shorter peg. The pegs

should be turned down to half an inch from pieces an inch in diameter, and a flattened ball left on the point of each. Otherwise, they and their connecting piece should be perfectly plain.

Holes may now be bored in the top and bottom rails for the reception of the upright pieces, in the latter

Fig. 40. — PORTABLE WARDROBE.

for the reception of the pegs, and in the pegs for the connecting pieces. In order that the upright pieces may move readily, the holes provided for them must be slightly larger than their pivots. The parts should now

be adjusted, by all the ends that are to be fixed being curved out to fit the rounded surface they are to be connected to, as we pointed out in the case of the music rack. This done, we may fix the pegs into the uprights with glue, and finally put the parts of the frame together, taking care before doing so to insert the upright pieces. Two strong screw rings will have to be fixed in the top rail, six or seven inches from the ends, and these provided, the wardrobe is complete, except a coat or two of varnish, which will improve its appearance.

HOW TO MAKE AN EGG-CUP.

So far our use of the lathe has been restricted to work supported between two centres. We shall now introduce another variety for the purpose of illustrating the capabilities of the lathe and its special appliances. In turning a bowl or egg-cup it will be evident that the work cannot be held in the lathe in the same way as the parts of the music-rack we have just completed. Here is a piece of sycamore, let us convert it into an egg-cup. It has been turned to a cylindrical form, by a process which we have already explained; and it has now to be held so that one end of it shall project and give ready access to the tools.



Fig. 41.—CUP-CHUCK.

Here the "cup-chuck" (Fig. 41) comes into requisition. It is a hollow cylinder of metal, having at one end provision for its being screwed on to the mandril of the lathe. There are usually several sizes of these chucks supplied with the lathe. We have selected one into which our cylinder of sycamore will fit somewhat tightly, or rather the wood has been adapted to the chuck. We press the cylinder into the chuck, leaving about two-thirds of its length projecting, and proceed to hollow out with a gouge the exposed end. This requires neatness of manipulation, and should not be done too hurriedly, as any attempt to get off a thick shaving is apt to displace the wood in the chuck. Having finished the interior of the cup, we apply the tool to the exterior, and reduce it, so far as the position of the wood will allow, to its ultimate form. We then remove the work, reverse it, and press the end we have operated upon into the aperture of the chuck. This leaves the part which is to form the shank and foot free for us to deal with; and we proceed to fashion them, taking care, as before, not to put much pressure upon the tools.

Hollow articles of various kinds may be made in the same way. In the case of flat, saucer-like vessels the attachment to the lathe is made by means of a chuck coated with "Turner's Cement," or furnished with a screw projecting from the centre of its flat surface. But here we need not go more into detail on this point; nor need we deal with eccentric and rose-engine turning, as they would occupy more space than we can afford, and may best be studied from the special treatises relating to them.

HOW TO PRODUCE A CUBE ON THE TURNING-LATHE.

At first sight it would appear to be an impossibility to produce a cube by turning, our ideas of things produced in that way having a relation to either spherical or cylindrical bodies. Yet it so happens that it is easier to produce an exact cube upon the lathe than it is to form an exact sphere. The cube is a six-sided solid, and all its sides are plane surfaces. In producing it by turning we proceed in this way:—Here is a cylindrical-shaped piece of wood, two inches in length and three inches in diameter. We desire to reduce it to a cube of two inches. Two of the six faces of the cube are already produced. To form the third we fix the cylinder by its side to a suitable chuck, and turn down the projecting side to a plane, by operating on it first with a gouge and then with

a chisel. The side thus planed is then attached to the chuck, and the fourth face is produced in the same way. Turning round the wood again, we proceed in a similar manner until all the six sides are completed. Of course, it will be noted that we are enabled to do this seemingly impossible piece of work by applying the tools to what we may call the end of the work as it revolves in the lathe, instead of to its side, as we do when making a cylinder.

HOW TO MAKE A WATCH-STAND.

Perhaps our pupil may desire to undertake some lighter and more artistic work than we have yet introduced him to. If so, he may try to make a watch-stand. Boxwood is a good material for this purpose; but he cannot venture to deal with it until he has made one or two additions to his tools, in the shape of smaller chisels and gouges, than he is yet supposed to possess. The wood is hard and admits of elaborate ornamentation.

There is a wide range of designs available for an article of this kind, and we propose to leave the details to the fancy of our pupil, merely suggesting that a stand in the form of a temple would be a suitable one to begin with. For this he will require to provide a circular platform four inches in diameter, with the central part of its upper side hollowed out to contain the watch-guard. From this platform four pillars of simple form should rise to a height of four inches, and support a dome-shaped canopy, hollowed out on its under side, and surmounted by a pinnacle about an inch in length. The dome should have a square base, the corners of which will rest upon the pillars, and the pillars should seem to be carried upward through these corners by little vase-shaped ornaments placed over them. In the centre of the dome, inside, a hook for hanging the watch upon should be provided. With these suggestions our pupil will, no doubt, be able to produce a really presentable article.

Ebony and ivory may be introduced with advantage in some of the smaller articles of turned work; but we need not go farther into the subject, as the pupil who has intelligently followed us thus far will find no lack of variety of work or of design.

SHIP-BUILDING.

THE sailing of model yachts is a favourite recreation, not only with boys, but with men of mature years. There is something truly exhilarating in the sight of a tiny vessel ploughing her way through the ripple which a summer breeze raises on mill-pond or river. It is a charming exhibition of grace and motion, and the contemplation of it is full of suggestiveness as to the avocation of "those who go down to the sea in ships." Many a boy has formed his resolve to embark upon a seafaring life and visit foreign countries while watching the voyages of his model schooner across the waters of a horse-pond; but there is no doubt that a like study has in many cases driven away the half-formed idea of becoming a mariner. In teaching our pupil how to construct a model yacht, we are, therefore, providing him with a means of healthy recreation, which will not necessarily unsettle his mind or create in him a desire to roam.

There are three essential parts in a sailing vessel—first, the hull, the movement of which from one place to another along the surface of sea, lake, or river is the object of the navigator; secondly, the sails, which are designed to receive the pressure of the wind, and so urge the ship on her way; and, thirdly, the cargo or ballast necessary to counterbalance the tendency of the wind, acting

upon the sails, to cause the hull to roll over. The form and rig of vessels differ in the various countries of the world; but the three parts mentioned they must all have.

It is possible to illustrate the principles embodied in a ship in a very simple way. The writer's first attempt at model yacht-making consisted in picking a piece of dried hemlock stalk from the bank of a pond, sticking a small piece of slate in one side of it to form a keel, and fixing a couple of fowl's wing-feathers in the other to make at once masts, rigging, and sails. There was not much beauty to boast of in a craft of this kind, but the rate at which it sailed was surprising.

A gift of a pocket-knife admitted of a nearer approach to a correct model. A piece of wood seven or eight inches long, an inch and a half broad, and half an inch thick, was cut to a wedge shape at one end to form a bow, and rounded a little on the bottom angles. A mast four or five inches in height was fixed about one-third of the whole length from the extremity of the bow. On the mast a piece of stout brown paper was placed as a sail, by having a hole in its upper and lower parts passed over the mast. In a hole bored in the under side of the broad end or stern of the boat a thin piece of wood was inserted to serve as a rudder. No mention is made of a keel or ballast here. The width of the boat being three times its depth gave it considerable stability without such accessories. So long as only light winds prevailed all went well, though no great speed was attained, but it did not require a very strong gust to make the awkward craft roll over.

There were numerous stages in the development of these rude vessels into a properly-modelled yacht. The solid boat, with small attempt at form, gave way to a fishing cobbler, hollowed out, fitted with thwarts and a calico sail; and that was succeeded by decked vessels of various rigs, culminating in a working model of a steamer. We shall presume that our pupil has gone through the incipient stages of yacht-making, and that he merely waits our instruction to enable him to make a complete model of a yacht that will sail satisfactorily.

HOW TO MAKE AND RIG A CUTTER YACHT.

For simplicity of construction, ease of handling, and (under given conditions) speed, there is nothing to beat the "cutter" form of yacht. Let us begin with that. The hull must be our first concern. We shall form it out of a piece of even-grained, well-seasoned yellow pine, as that wood, while hard enough and strong enough to stand any usage our vessel is likely to be subjected to, is easily carved. A yacht with a hull measuring two feet in length is a convenient size. It is not too large for a youth to carry some distance, and is likely to be found handy in every way.

Here a word as to the proportions of the yacht. Experience has demonstrated long ago what width and depth in proportion to length will give the best results as regards stability and speed, the latter quality being regulated, besides, by the shape given to the craft. Experience must, therefore, be our guide. Makers of yachts for the toy-shops frequently despise this teaching, and produce vessels in which both stability and speed are sacrificed to a ridiculous leanness of form. We desire to do something better, and shall not take these fancy ships as our model. Having fixed the extreme length of our hull at twenty-four inches, we shall require to give it a width (or beam) of five inches and a depth of the same.

After planing and squaring the block of wood from which we are to carve our yacht, we draw a line along the centre of two of its opposite sides, and connect these lines by others drawn across the ends. One of the sides bearing the line is to be the upper or deck part, and the other the keel. The lines are

to be our guide all through the shaping of the hull, and should be drawn very exactly and distinctly. A line drawn across the deck at its middle distance is also necessary. From a point an inch nearer to one of the ends than the last-

mentioned line two curved lines are to be drawn to indicate the fore-part of the vessel. These curved lines meet at the extremity of the longitudinal line, and in drawing them

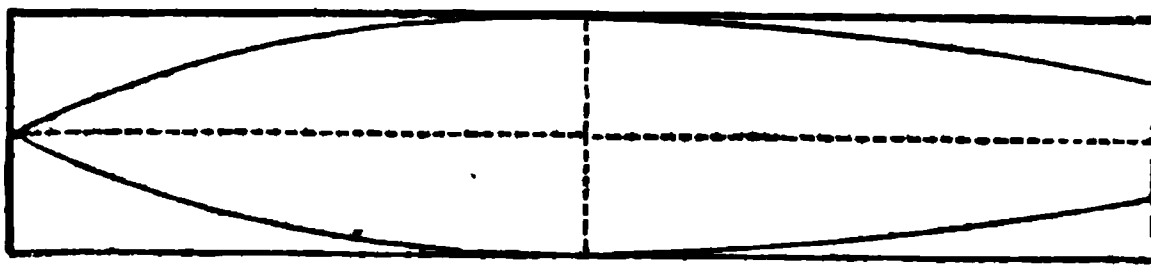


Fig. 42.—DECK-PLAN OF CUTTER.

we must take great care not to make the curve too flat or too full. From the point at which these curved lines start we must draw another pair of lines toward the stern. These are not brought together, but terminate at points previously marked an inch and a quarter inside from the edge of the wood at its extreme end. The arrangement of the lines is shown in Fig. 42. It would be a simple matter to make a yacht if we had only to cut downward perpendicularly on these lines; but a more difficult task is before us, as we have to form curves which vary both vertically and longitudinally all the way down to the keel. An elevation of our yacht is shown in Fig. 43.

Before proceeding with the shaping of the bow and sides, it is desirable to cut out the wood from beneath the "counter," or projecting part of the stern.



Fig. 43.—ELEVATION OF CUTTER.

A convenient size for the counter will be a length of three inches, and a depth of one inch and a half, tapering outward to three-quarters of an inch. The sternpost beneath

should have a slope of from fourteen to sixteen degrees inward on the keel. Having sawn out this part we may proceed with the shaping. As a considerable quantity of wood has to be removed from each side of the bow, we may facilitate operations by sawing off a wedge-shaped piece from each side. Our block of wood will now present a rude approximation to its ultimate form. Laying the wood on the bench with the deck side below, we may attack it boldly with chisel and gouge, taking care, however, not to cut too deeply at any point.

As the work advances we must make frequent measurements. The midships section should be determined by drawing on paper, and shaping a piece of cardboard to the curve. The gauge thus formed we apply to the sides of the vessel, and cut away the wood until we obtain a fit. With the yacht-builders of earlier times the midship section was cylindrical, now it is usually composed of a double curve, as shown in Fig. 44. The latter form is most advantageous in keeping the yacht to the wind, and also in making her feel the ballast when there is a pressure on the sails. The fullest part of the hull should be midway between the stem and sternpost, and the tapering towards each end should begin at that point. It is not necessary, as some yacht-builders seem to suppose, to give a long straight side or "middle body" to the vessel. An object to be desired is to make the two ends of the vessel below the load-line, or level of immersion, equal as

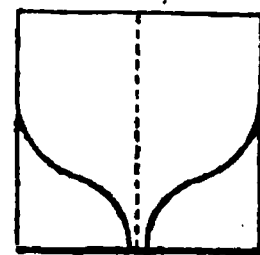


Fig. 44.—SECTION OF CUTTER.

regards the space they occupy in the water, and also nearly similar in form. In some cases an advantage is sought to be gained by making the fore part of the vessel sharper than the rear part or "run," while in others a reverse process is tried; but unless the displacement be equalised in some way the result is not satisfactory.

Having pared down the wood until the desired form is obtained, and each side has become a *fac-simile* of the other, a result only to be reached by frequent testing with cardboard moulds, we fix the hull in an upright position, and begin the work of hollowing out. For this purpose we require well-sharpened gouges. At the first cutting we keep half an inch from the sides, three inches and a half from the stern, and two inches from the bow. We must not be in too great a hurry over the job, else we shall run a risk of splitting the bulwarks. When we have cut well down towards the keel we may begin to thin away all round, remembering that the more wood we cut from the inside without endangering the strength of the yacht the greater buoyancy we shall secure. At this stage the "sheer" should be formed—that is, a slight hollowing of the horizontal line of the vessel, an arrangement which serves to keep the decks dry, while at the same time it gives a graceful outline to the craft. The bulwarks require some nicety of treatment. They should be cut to the depth of half an inch, and should not be more than an eighth of an inch in thickness. At their base a ledge a quarter of an inch wide should be left for the deck to rest upon and be nailed to, and the solid parts at each end should be reduced to the same level.

Lead ballast in the form of a "false keel" should now be attached. The weight of lead necessary will depend largely on the extent to which the hull has been thinned out. If we say between four and five pounds we shall not be far out. The lead may be procured at a plumber's or ironmonger's shop, and it does not matter in what form it is got, as it has to be melted and cast in a mould. The mould we make from some laths of convenient size. We first take a piece two feet in length, and reduce it to a thickness of three-eighths of an inch. This is to form the bottom of our mould, and into it we drive half-a-dozen nails, which we mean to become embedded in the lead for the purpose of fastening it to the vessel. The sides require two similar pieces of lath about two inches in width. The side pieces we nail on the bottom piece in such a way as to form a narrow channel an inch and a half in depth and three-eighths of an inch in width. We then measure the length of the keel of our yacht, and fix ends or stoppings in the mould to mark that off. Now all is ready for our casting operation. We melt the lead in an iron ladle, and pour it into the mould. The metal soon consolidates. We pull the mould to pieces, and there our keel stands revealed in a bar of glittering metal. It is of equal depth and thickness throughout, and this we must alter, as it is desirable that it should be thinned somewhat at both ends, and that it should not be so deep at the bow as at the stern. A few passes of a plane set this right; the lead yields readily to that tool. With a chisel we cut the stern end to suit the line of the stern-post, and round the lower angle of the bow extremity. For each nail we now make a slight puncture in the bottom of the yacht, and setting the lead keel even, we drive it home with a hammer, using gentle blows over the nails in succession. Should any of the nails present their tips inside the vessel, these should be bent down or "clinched."

We may now proceed to fit our deck. This should be formed of a nice clean piece of pine, a full eighth of an inch in thickness. We choose the wood of greater length than we need, so as to allow for misfit. We cut it to fit the bow part first, and so on along the sides until it drops easily upon the ledge provided for it. It improves the appearance of a model yacht to have the deck appear as if planked. This is done by drawing with a bodkin a series of longitudinal lines

a quarter of an inch apart. Before fixing the deck we must bore a hole for the mast, and another for the rudder. The position of the former is determined by experience, and in our twenty-four-inch vessel should be eight inches and a quarter from the tip of the bow. As the mast should be half an inch in diameter, a hole of that size must be bored through the deck at the point indicated, and immediately beneath it a hole must be made in the interior of the vessel for fixing the lower end, or "foot," of the mast.

These provisions having been made, the deck may be fixed. A layer of putty should be spread on the ledge, and the deck pressed firmly down on that, and then nailed. If the yacht is intended for the serious work of sailing in matches it is not advisable to rig her heavily, nor to crowd her deck with models of companion ways, skylights, winch, or windlass. Should our pupil desire to make a perfect model he may easily do so by the expenditure of time and a little money: but we shall presume that he has no such desire, and that he merely wishes to possess a yacht that will sail well, and give the least possible trouble in working.

Masts, yards, rigging, and sails next demand attention. As we have said, the mast should be half an inch in diameter. This and the other spars may be made of pine free from knots or flaws. Some other woods would be stronger, but in pine we have lightness combined with sufficient strength, and lightness in all parts above deck on a yacht is an important quality. The mast is made in two parts, called the "lower-mast" and "top-mast." The former must have a height between the deck and its junction with the top-mast of three times the width of our vessel at the widest part, or fifteen inches. If to this we add four inches for the part below the deck, and two inches and a half for the mast-head, we have a total length of twenty-one inches and a half. Taking a piece of wood of this length, and half an inch in diameter, we plane it to a round form, and make it perfectly smooth by scraping and the use of glass paper. The lower end has to be pointed, to fit into the hole prepared for it in the hold of the yacht. The upper end has to be reduced, to adapt it to junction with the top-mast. Marking off a part two inches and a half from the extremity, we reduce its diameter by about one-half. At the extremity of this reduced piece we mark off a portion a quarter of an inch in length, and bring it to a smaller section. The object of both these reductions will be apparent on reference to Fig. 45, where it is seen that the cross-tree and its "cap" are mounted on the lower part of the squared portion, and the "upper-cap" on the narrower portion.

Fig. 45.—MAST-HEAD.

But we must revert to the hull for a moment. For convenience of working we have to provide stocks for it, on which it shall stand in an upright position. This we do by shaping two pieces of wood to the bottom of the vessel at points about three inches from either extremity. These pieces we fix upright on a board two feet in length and seven or eight inches broad. As thus held the vessel may receive her spars and rigging. Before setting these up, however, it may be well to paint the hull, as a preliminary to which it should receive a final smoothing with a scraper and glass paper. The deck will look best varnished simply, and

that may be done at a later stage. For a first, and perhaps a second, coat, a mixture of black and white paint, which will produce a grey, may be used. The final coat should be of green to near the line of flotation, and black above that, with a narrow yellow or gold band marking the depth of the bulwarks. It will be convenient to make and fix the rudder before painting. The rudder should be made of pine, and its upper part should fit into the hole prepared for it so firmly as to remain in whatever position it may be adjusted, and yet not too tightly, else it will become jammed when the water causes the wood to expand. It is fixed to the "stern-post" by means of hooks and staples made of copper wire.

Now we drop the mast into its socket, first placing upon it a dozen brass rings three-quarters of an inch in diameter, and proceed to make the cross-tree and caps. As the caps will be subjected to considerable strain, we employ beech in their construction, or they may be formed of soft brass. The cross-tree, which may be made of a piece of flattened brass wire, should have a total length equal to the beam or width of the yacht, and in each end of it a hole should be drilled to receive the stays. The arrangement of the parts is distinctly shown in the engraving on the preceding page (Fig. 45).

The bowsprit may now be taken in hand. It is a spar projecting from the bow of the yacht to carry the head sails, and its length outside the vessel should be about twice the beam, say ten inches, while a length of two inches will be required inboard to fix the spar securely. At the inboard end it should be three-eighths of an inch in diameter, tapering gradually to a quarter of an inch at the extremity. For its reception a notch must be cut on the top of the stem, and, as it will be convenient to provide for the bowsprit being drawn in, two staples of copper wire must be driven into the deck, one on each side of the inner extremity, or "heel" of the spar. A movable pin passing through these staples and the bowsprit will hold the latter securely, while admitting of its being readily unshipped.

To give variety to our work, we may, before making the other spars required, set up the "standing rigging" connected with the lower mast and bowsprit. The term "standing rigging" is applied to such stays and shrouds as are fixed, as distinguishing them from the "running rigging," which is the designation of halyards, sheets, and tacks; which are being shifted frequently in working a vessel. In yachts of full size, the mast is usually supported by three or four shrouds on each side, and these are formed into ladders for the sailors by cross-pieces, called "ratlines." As we do not require to provide in our model for sending men aloft, and as we desire to carry as little rigging as possible, we shall content ourselves with two shrouds on each side, and dispense with the "ratlines" altogether. For the shrouds and other parts of the rigging we require various sizes of hard water-spun cord, such as fishing-lines are made of. The use of the shrouds is to enable the mast to resist the strain of the sails, and they are



Fig. 46.
DEADEYE.

fastened round the mast-head, and led thence to "deadeyes" fixed on the bulwarks. Deadeyes (Fig. 46) are small discs of hard wood, ivory, or lead, with three holes bored through them, and their rims fluted or hollowed out to receive a cord. Two deadeyes are fastened to the bulwark on each side of the mast with straps of copper wire, and one is attached to the lower end of each shroud, the length of the shroud being such that when its deadeye and the corresponding one on the bulwark are brought opposite to each other, they shall be half an inch apart. The shroud is attached to the bulwark by lacing the deadeyes together with a small cord, known as a "lanyard." The length of the shrouds and the strains applied to them have to be nicely adjusted, so that the mast may be kept in a truly perpendicular position.

A cord of similar thickness to the shrouds is required for the "fore-stay."

which leads from the masthead to the stem of the yacht, and should be fastened to a staple of copper wire spanning the bowsprit. The rigging of the bowsprit consists of a shroud on either side, leading to a point near the foremost of the mast shrouds, and fixed there. These shrouds are on large yachts furnished with "whips," or tackle whereby they may be tightened up when necessary, but with such appliances we can dispense. From the end of the bowsprit to a point about half way down the stem of the yacht a third shroud, known as the "bob-stay," is fixed, and takes the strain of the "jib-stay," which latter leads from the end of the bowsprit to the mast-head. The jib-stay does not require such a stout cord as the shrouds or fore-stay. It will be noticed that the strains on the mast are rather unequal, the fore- and jib-stays tending to drag it forward against the resistance of the shrouds. Hence another pair of stays are necessary. These lead from the masthead to points on the bulwarks about the width of the deck to the rear of the mast, and are known as "runners." They are furnished with "whips," and these we provide by cutting the main part of them so that they reach only to within five or six inches of the bulwark, and attaching to each of them a small block. A cord passed through this block supplies the means of making the runners taut.

We may now proceed with the other spars required—namely, the topmast, the main-boom, the gaff, and the gaff-topsail yard. The topmast must have an extreme length equal to three-quarters of the length of the lower mast from the deck to the crosstree, or eleven and a quarter inches. Its diameter at the base should not exceed three-eighths of an inch, and it should be tapered upward to three-sixteenths at the extremity. The lower end is squared and fitted into the lower cap, and just above the latter a peg is inserted, in order to prevent it from slipping down. About an inch from the top of the topmast a small notch is formed to hold cords which are carried down on each side, and, passing through the tips of the crosstree, are made fast to the bulwarks. These cords are called the "topmast shrouds," or "standing back-stays." From the same part of the mast a cord—the "topmast-stay"—extends to the point of the bowsprit. A ball of wood about the size of a pea is stuck upon the top of the mast, and forms the "truck" through which the signal halyards are passed. One more stay, and the topmast rigging is complete. This is the "preventer," or "shifting back-stay," which is attached to the top of the mast, and led away to the extremity of the stern. It is only put into requisition when the vessel is running before the wind, and there is consequently much pressure on the mast in a forward direction.

Spars used at the upper part of sails are called yards or gaffs, and those at the lower part are known as booms. Only on special occasions are booms fitted to the head sails, but the sails carried abaft the mast are all extended by yards and booms. The main-boom in a cutter is strikingly large when compared with the size of the vessel. For our craft we require a boom eighteen inches in length. In the central part it must be three-eighths of an inch in diameter, tapering slightly towards the ends. The end next the mast is crutch-shaped, so as to fit round half the circumference of the mast. The gaff, as the yard of the mainsail is called, should be thirteen inches in length, and considerably smaller in diameter than the boom. It also has a crutch-end to fit the mast. The gaff-topsail yard will be a trifle shorter and lighter. In making these spars care should be taken to make them as round and smooth as possible.

Blocks will have to be provided and fixed for the running rigging. Beautifully-made blocks and other fittings for model yachts may be purchased at the nautical toy-shops; but as our pupil may not be within reach of an establishment of that kind, we shall show him how to make blocks. A block is simply a pulley, and for large yachts they are made with metal sheaves. We shall do very well without sheaves. Here is a strip of beech one-eighth of an inch in thickness,

a quarter of an inch in width, and a few inches in length. With a fine bradawl we bore through the wood from one edge to the other a series of holes about half an inch apart. With a knife we then shape and cut off a portion of the wood retaining the hole nearer one end than the other. Fig. 47 shows the completed block, and the manner in which it is attached. Having finished one block, we proceed to cut out another, and so on until we have made as many as we require, which will be under a dozen. It is possible to introduce many blocks into the rigging of a model yacht, but our object, for reasons already explained, is to have as few as possible. We shall do nicely with a couple at the topmast head for the flying jib and gaff-topsail halyards; two under the foot of the topmast for the jib and foresail halyards; two behind the lower masthead for the throat and peak halyards of the mainsail, and the two already mentioned as being used on the runners.



Fig. 47.
Block.

Things are now so far advanced that we may give some attention to the sails required for our craft; but before actually proceeding with them, we may treat the vessel and her spars to a coat of varnish. While we are engaged in sail-making the varnish will consolidate, and no time will be lost in getting the yacht afloat. Not only the appearance of a yacht, but her sailing qualities, depend to a large extent on the manner in which her canvas is cut, sewn, and attached. As in the spars and rigging, lightness must be a consideration in dealing with the sails. At the same time, the material employed must not be too delicate. A closely-woven calico of moderately fine quality and free from size will suit our purpose.

We require five sails—main-sail, foresail, jib, flying-jib, and gaff-topsail. All these are of a triangular shape except the first and last, which are of irregular quadrangular outline. The first stage of sailmaking is to cut out paper patterns, and adjust them to the spars and stays. In making the sails for large yachts there are various technical points observed which we need not trouble about. Our object shall be to preserve all the edges of the sails straight and free from puckering in the hemming. The mainsail after it is hemmed should be about half an inch within the extremities of the boom, as the lower spar to which it is attached is called, and the gaff, as the upper spar is called. The edge of the sail which goes next the mast is called the "luff," the lower end of that edge the

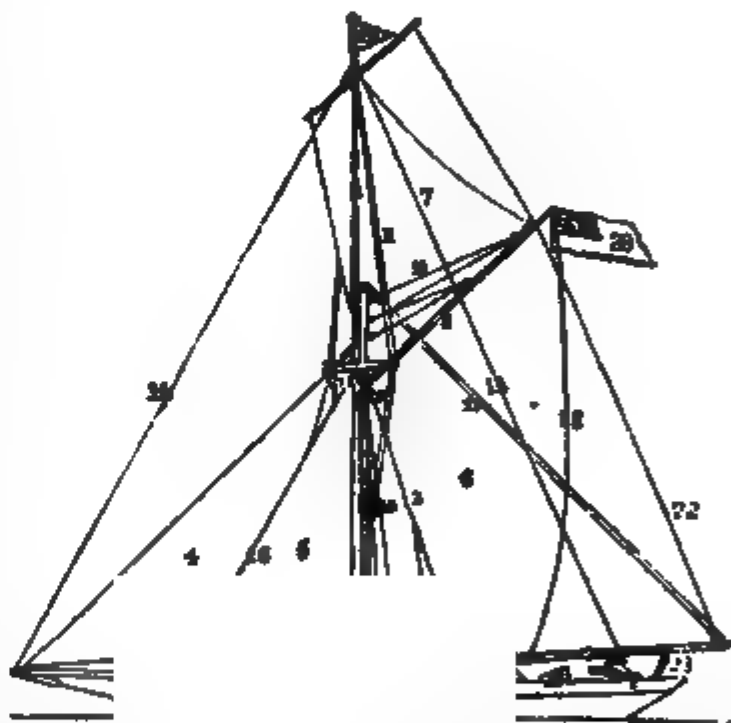


Fig. 48.—Diagram of Cutter Yacht.

- | | |
|-------------------------|-------------------------|
| 1. Lower Mast. | 16. Bob-stay |
| 2. Topmast. | 17. Main Boom Lifts. |
| 3. Bowsprit. | 18. Ensign Halyards. |
| 4. Jib. | 19. Mainsail Halyards. |
| 5. Foresail. | 20. Throat of Mainsail. |
| 6. Mainsail. | 21. Cross-tree. |
| 7. Gaff-Topsail. | 22. Leech of Mainsail. |
| 8. Mainsail Gaff. | 23. Mainsheet. |
| 9. Main Boom. | 24. Tiller. |
| 10. Lower Mast Shrouds. | 25. Companion. |
| 11. Topmast Shrouds. | 26. Bulwarks. |
| 12. Runner. | 27. Hull. |
| 13. Preventer. | 28. Ensign. |
| 14. Topmast-stay. | 29. Burgee. |
| 15. Fore-stay. | 30. Foresheet. |

"tack," and the upper end the "throat." The luff is sewn to the rings which we placed upon the mast when "stepping" it, the rings being attached about an inch apart. The lower edge or "foot" of the sail is not connected with the main-boom except at the tack and the outer corner, or "clew." The outer vertical edge of the sail is called the "leech," and is the only part not attached to a spar. The top of the sail is called the "head," and its extreme point the "peak," and it is attached to the gaff by a series of cords or stout threads passing through the seam and over the gaff. It is usual to give the head of a cutter's mainsail an angle of about fifty degrees from the horizon. The form of this and the other sails will be seen in Fig. 48. The mainsail is hoisted and lowered by means of halyards attached at the inner end or throat of the gaff, and at a point about two-thirds out on the yard. The latter is called the "peak halyards." All that is required to complete the mounting of the mainsail is the "sheet." This is a cord attached to the boom at a point just inside the stern, and fastened to a ring which is free to slide from side to side of the stern upon a brass wire extending across the deck. By this arrangement the sail requires no attention when the yacht is sent on a fresh trip, as it adapts itself to the direction of the wind.

The foresail has its longest edge or "luff" attached to the fore-stay by means of a series of small rings. Its tack is fastened close down to the staple which holds the fore-stay, and its head is attached to the halyards which pass through the block provided for them, and are led down along the mast to cleats or other fastenings near the deck. To the "clew," or loose corner, the sheet is fastened, and for fixing it a cleat is provided inside the bulwarks on each side a little way abaft the line of the mast. Sometimes the foresail sheet is provided with a "horse" or runner like that of the main sheet, and when so mounted the sail gives no trouble in changing the course of the yacht, as it slides into position under the pressure of the wind.

As regards the jib and flying-jib little requires to be said. The position of the former is clearly indicated. The flying-jib is not shown in the engraving. It is a triangular sail, mounted midway between the topmast head and the point of the bowsprit.

Fully equipped in the manner we have described, the yacht may be set afloat, and we shall be much surprised if she does not by her speed and beauty on the water give ample recompense for the labour expended on her construction. We might add a word about the steering of the vessel; but the owner will soon discover the use of the rudder for himself. As regards the sails care must be taken in setting out the yacht on a voyage to have all the sheets—or ropes attached to the rear lower corner of the sails—fastened down to the lee side, that is, the side opposite to that on which the wind blows. The main sheet is self-acting, and the foresail, as already stated, may be the same; but the jib and flying-jib sheets will have to be untied and shifted at each trip.

In order to protect the yacht from dust and injury when she is laid up at home a case should be provided for her. This may be readily constructed out of a shallow packing-case, set up on edge, furnished with a glass door, and painted.

The rig of the cutter, as we have seen, is extremely simple, and so also is that of the yawl. The latter has a smaller mainsail than the cutter, so that the end of the mainboom comes in a little distance over the stern. To compensate for this reduction of the mainsail, a miniature sail called the "jigger" or "mizen sail" is provided, and rigged outward from the centre of the stern. For many purposes the yawl rig is very useful, and in practice requires fewer men to work it. In most circumstances yawls sail as well as cutters, but they will not sail so close to the wind. A cutter with her sheets pulled tight will run almost directly "in the wind's eye," and this feat is one that surprises inexperienced people

who witness it. The sails and rigging of a yawl bear the same names, and are fitted in the same way as those of a cutter, the only exception being the allowance that has to be made for the accommodation and working of the jigger.

HOW TO MAKE AND RIG A SCHOONER YACHT.

A more complicated and prettier rig than either cutter or yawl is that of the schooner. Here we have sails of entirely novel form introduced, and two full-sized masts for their support. There are four varieties of schooner, known respectively as the topsail schooner, the fore-and-aft schooner, the two-topsail schooner, and the three-masted schooner. Of these we prefer the first-named, and will describe how to make and rig a vessel of that kind.

As regards the hull the varieties of schooners named need show no difference. A schooner carries her canvas lower in proportion to her length than a cutter does, and consequently does not require to be so deep in the hull or so heavily ballasted, but the length in proportion to the width should be about the same. A straight stem, rounded inwards at the junction with the keel, is the form best adapted for a cutter. A schooner looks best with a stem curving outward at the upper part, and terminating in a figure-head. With these hints our pupil need not have any difficulty in fashioning the hull of a schooner.

As to rigging, the same remarks made with regard to the cutter hold good—all superfluous cordage and fittings should be omitted. The masts are both smaller in proportion to the dimensions of the hull than the cutter's mast, and the spars altogether are lighter. In a schooner twenty-four inches in length the foremast should be seven inches from the extremity of the stem, and the mainmast should be seven inches nearer the stern. The foremast, from the cross-tree to the deck, should measure twelve inches and a half, and the mainmast half an inch more. The topmasts need not exceed nine inches each. The mast-heads, caps, and cross-trees should be of the same form as those of the cutter, except that the foremast cross-tree should measure only half the width of the deck. The curtailment of length is necessary to allow the topsails to be braced round. There is much more work in rigging a schooner than in rigging a cutter. To begin with, there are two masts with their standing rigging, two topmasts, a bowsprit and jibboom, with booms, gaffs, and yards for the square sails. Thus the running rigging is proportionately increased.

Let us set up the masts and topmasts and fix the bowsprit and jibboom, the latter being a continuation of the bowsprit similar to a topmast. It will save trouble and answer all practical purposes, however, if we make the bowsprit and jibboom in one piece, the measurement outside the stem being ten inches. Two pairs of shrouds will suffice for each mast. The bowsprit should have a shroud on each side and a martingale, or "dolphin-striker." The latter is a small boom extending downward from the point where the bowsprit and jibboom are supposed to join, and it has a stay leading to its lower end from the point of the bowsprit, and two stays leading thence to each side of the bow at the line of the deck. This converts the bowsprit into a sort of girder, and gives it sufficient rigidity to resist the strain of the head sails.

The head sails consist of a foresail similar to that of the cutter, two jibs—one having its "tack" fastened at the extremity of the jibboom, and the other at a point midway between that and the stem. When hanging loose these sails should overlap a small way. A flying-jib may be added in the same position as on the cutter. The mainmast has two sails to carry—the mainsail and the gaff-topsail. These are like the same sails on the cutter, but, of course, considerably smaller. The mainboom should extend between two and three inches over the stern.

On the foretopmast are the topsail and topgallantsail. These are mounted on yards, pivoted on their centres. The lower of these yards, called the foreyard,

should be twelve inches in length; the next, or topsailyard, two inches less; and the upper, or topgallantsailyard, eight inches. The largest yard should be about a quarter of an inch in diameter in the centre, tapering gradually to the points. The others should be of proportionate dimensions. The topsail and topgallantsail are laced to the yards at their upper edges, but are attached by the corners, or "leeches," only to the yards beneath them. The arrangement of the sails of a schooner is

HOW TO BUILD A MODEL

Carving a model yacht of wood is, after all, a rather mode of working, and suggestive followed by savage people using trunks of trees into the form of canoes. It is, as we have seen, a simple process to convert a piece of pine into the form of a ship; and the difficulty of constructing one out of planks in imitation of full-sized vessels is so obvious that it is hardly to be wondered at that "built"

Fig. 42.—SCHOONER.

model yachts are so rare. It is just possible that the difficulty of the work is over-estimated, and that we may be able to explain ways of building model yachts that will encourage some of our readers to make a trial.

A cutter measuring two feet in extreme length of hull will be a convenient form and size of vessel to undertake, as our pupil is already familiar with the proportions, &c., of such a craft, and, we will presume, has made one, which will serve as a guide in the building of another. As in the building of large ships, we must begin by preparing working drawings. We first lay off the deck plan (Fig. 42) and then a side view or elevation (Fig. 43). These will be useful for measurements in many ways. Other drawings will require to be made from time to time as we proceed.

There are various woods that may be used in building a model yacht. We



Fig. 50.—YACHT: STEM, STERN, AND KEEL.

prefer mahogany, and shall require some pieces a quarter of an inch thick, from which to cut the ribs or "timbers" of our ship; an even-grained board two feet in length and three-eighths of an inch thick, from which to cut thin slips to form the planking or "skin" of the vessel; and a few pieces about half or three-quarters of

an inch square, to form the keel, stem, stern-post, and so forth.

It will be evident that our work of construction must begin with the keel,

which is in reality the foundation of a ship. For this important part we select a suitable piece of wood and bring it to the following dimensions: length, nineteen inches and a half; breadth, five-eighths of an inch; thickness, three-eighths of an inch. One edge of this piece will form the outside or "false" keel, and to the other the ribs will be attached. We must next prepare the stem or bow timber, and attach it to the keel. The stem is of peculiar form, and must have a groove cut in each side to receive the ends of the planks which will form the "skin" of the ship. The stern-post is somewhat similar in form, but slopes outward. The shape and position of both parts as attached to the keel are shown in Fig. 50. Before fixing them to the keel, however, we must cut a series of notches in the latter for the reception of the ribs. The notches should be one-quarter of an inch in width and the same in depth, and cross the keel at right angles. In the sides of the keel, three-eighths of an inch from the top, grooves must be cut similar to those in the stern, for the reception of the edge of the lowest course of planking. The stem and stern-post having been attached to the keel, this part of the structure may be set upright on stocks made of two or more notched pieces of wood attached to a piece of board about the length of the ship.

So far the work has been simple enough; but we must now shape and fix the ribs, and that we shall find a more difficult task. The easiest way of

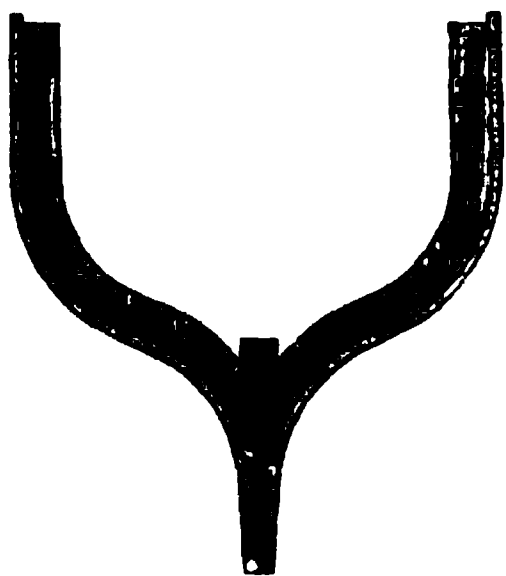


Fig. 51.—RIBS FITTED TO KEEL AND KEELSON.

proceeding is to take the yacht we are using as a model, remove part of her rigging for convenience of handling, and then divide her hull transversely by pencil lines corresponding to the number and position of the rib notches in the keel of our new craft. This done, we make a model with cardboard of the perpendicular form of the hull at the widest part, and on the transverse line that falls nearest to it. This will give us the form of the central rib, which we proceed to lay down on paper in this way:—Drawing a square outline corresponding with the width and depth of the hold, we place the shaped cardboard on that and copy its outline. This we next reduce by an eighth of an inch to allow for the planking. A little care at this stage will be well rewarded by a saving of subsequent trouble.

Having defined the external form of the rib we shape its internal form. As the ribs are not to be nearly so numerous as they are in large ships, we can make a good allowance for depth, so as not to risk splitting the wood. The fact that our ribs are to be cut in one piece, and so necessarily contain some cross-grained parts, also makes it desirable that we should not fashion them too slenderly. Three-eighths of an inch at the sides and slightly more in the centre will suit our purpose. We now transfer our drawing to the board, already reduced to a thickness of a quarter of an inch, and cut out the rib with our compass-saw, allowing a little wood all round for trimming. The spokeshave will now be found useful, and with it we smooth the sawn faces of the rib and reduce them to the dimensions indicated by the lines.

The rib thus formed we set into its notch in the keel, taking care that it projects equally on each side. It is not to be fixed yet, but the notch is expected to be tight enough to hold it firmly while its neighbours are being prepared. We now return to our model, and taking off the pattern of the next rib towards the bow, proceed in exactly the same manner; and so on, until we have a complete set. As we recede from the central line in either direction we must give to the outside of the ribs a form corresponding with the fore and

aft taper of the hull. The eye, aided by a cardboard gauge, will guide us to what is necessary in this way; as the stem and stern are approached the internal space becomes so narrow that the ribs may be left solid, like "bulkheads." This will at once give increased strength and save trouble. The "counter," or projecting part of the stern, requires special treatment. When the planking has been done up to the top of the stern-post it has to be extended outward about three inches, and to support it in that position a rib, shaped to correspond with the form of the counter, has to be attached to the upper end of the stern-post, and to that a solid piece, to form the extremity of the counter, has to be attached by two suitable beams.

The material for the skeleton of our yacht is now complete. But it has yet to be fixed. The ribs are, it will be remembered, only temporarily in position, and they must be finally adjusted and attached to the keel. To hold them in the first instance we shall use glue—a substance, by the way, not quite suitable for making attachments in structures to be subjected to the action of water or the effects of damp, but which will serve us here till more lasting means of fixture are applied. Removing all the ribs and placing them aside in order, we begin to glue them into the notches in the keel, starting at the bow and working toward the stern. As a guide during this operation we should have a strong thread stretched from the centre of the top of the stem to the centre of the top of the stern-post, and by applying the compasses or a marked rule to that and to the outer top extremity of the ribs, we shall be able to adjust the ribs exactly, and it is all-important that this part of the work should be accurately done.

When the glue has dried thoroughly, an inner keel or "keelson" must be fitted over the ribs at the junction with the keel, and nailed down to both ribs and keel. The arrangement of the parts is shown in Fig. 51.

We may now prepare our planking. Taking the mahogany board provided for this purpose—which, it will be remembered, is three-eighths of an inch thick—we saw from one of its sides a succession of slips a little over one-eighth of an inch in thickness. These are reduced by planing to a uniform thickness of one-eighth of an inch. Taking one of these slips, we nail it temporarily along the outer side of the upper ends of the ribs, so as to secure them more firmly while the planking of the lower part is being done. We may now lift the skeleton off the stocks, and turn it upside down for convenience of working, taking care to rest it so that no undue strain shall come upon any part. The planks next the keel may then be fitted. Each may be in one piece, extending from stem to stern-post. By making some of the planks on the more curved parts of the hull in two or three pieces, we shall get a more satisfactory fit.

As the nails fastening the planks to the ribs must have no projecting heads, we think it best to use pin-points, slightly roughened with a file to make them hold, and cut off with a pair of scissors into lengths of three-eighths of an inch. Holes for these should be bored with a bradawl of very small diameter, and should only be deep enough to let the point just enter the ribs. The planks, which should be thinned a little at the extremities, should be very exactly fitted into the grooves in the stem and stern-post. A coat of white or red lead applied to their edges and ends will help to make the vessel water-tight. As the planking proceeds the structure becomes more and more substantial, and may be more freely handled. The planking proper should terminate one-eighth of an inch above the tops of the ribs, and on the latter the deck should rest. An additional course of planking will provide bulwarks, and it may be attached to stanchions fixed to the inside of the lower planking or to the ribs.

The nails, which need not in the first instance have been driven in closely, may now be rubbed down with a file. This will have the effect of spreading out the metal, forming on each nail a sort of head. As it is probable that even with

the greatest care little irregularities will occur in the surface of the planking, the whole should be gone over with a scraper, and rubbed with glass paper. The exposed edge of the stem and stern-post respectively may at the same time be thinned away somewhat. Where any slight openings occur between the planks they should be filled with putty, with which some red lead has been mixed. Two or three coats of varnish will give the surface a glass-like finish, show up the grain of the wood, and render the vessel perfectly water-tight.

As the masts, rigging, sails, and lead-keel of a cutter have been already described, we need not refer to them again. It is not to be expected that any advantage in the matter of sailing will be gained by building a yacht instead of carving her out of the solid; but when built she is more truly a model, and in her construction provides more interesting recreation.

Working models of steamers are held in high esteem by young people, and we shall be expected to explain how they are made. This expectation we shall endeavour to fulfil when we come to give lessons in amateur engineering.

WORKING IN METALS.

THOUGH working in metals may not be quite so cleanly an occupation as working in wood, it has charms of its own, and provides a variety of recreation to the amateur mechanic. The metals used in the arts present a wide range of materials capable of application in innumerable ways, and a knowledge of their individual peculiarities and fitness for specific purposes is invaluable to all in any way concerned with industrial products. Some metals are hard, some soft, some tough, some brittle. Variety of colour, too, they have, and that is important in its way; and then the degree of fusibility they display, and their action generally under the application of heat, differs so considerably as to claim special attention from those who would undertake their conversion to any purpose.

No youth with his eyes open as to what surrounds him can fail to be acquainted with the more prominent characteristics of the metals most commonly in use. The present has been named the "Iron Age," and the reasons for that happy designation are not far to seek. Indeed, it would be difficult to name anything we possess in the production or transport of which iron has not played a more or less important part. Now, how is it that iron has come to occupy this important position? Simply because it is abundant, and because it possesses strength and beauty, and may be readily adapted to almost any requirement. Iron may be melted and cast into the most complicated forms; it may be shaped under the hammer, chipped, filed, planed, or turned; and it is susceptible of taking, and under certain conditions retaining, a mirror-like polish. A slight alteration in its character converts it into steel, and in that form its usefulness is enormously increased.

When the iron ore is melted and the metal run off into "pigs," as the bars into which it is moulded at this stage are called, it is known as cast-iron. The pigs may be melted again, and "cast" in sand moulds into any desired shape. In this condition the metal is used for the framing of machinery, steam-engine cylinders, pipes for the conveyance of gas or water, garden railings, pots, pans, and innumerable other articles. Cast-iron is brittle—that is, it will break before it will bend; but it is remarkably strong notwithstanding this characteristic. One noticeable thing about cast-iron is its hardness. A file in unskilful hands makes little impression upon it, and chipping it is a very tough job. The amateur mechanic is not likely to undertake any work in which cast-iron is used, nor is it probable that he will employ the material known as malleable cast-iron.

The latter is a variety of the metal which, while admitting of being melted, is so soft that it may be bent and shaped with nearly as much facility as malleable or wrought iron, and it is now to a large extent taking the place of simple cast-iron in the construction of machinery.

It is in its malleable form that iron is most extensively used, and only in that form will we deal with it here. If we take a piece of iron wire a quarter of an inch in diameter, and, say, six inches in length, we may soon test its qualities. Let us heat it in the fire till it assumes a pale yellow colour, and then, pulling it forth with a pair of pincers, place it upon the anvil—a flat-iron which has lost its handle will do very well for an anvil if we turn it face up. A few blows with a hammer will flatten the wire on the upper and lower sides, and if we turn it half round and strike it again we shall speedily have reduced it to a square form. If we measure its length now we shall find that it has increased considerably under this treatment, and if we go on hammering we may lengthen it out indefinitely. This quality of iron, which is common to nearly all the metals in a greater or less degree, is known as ductility. Again, if we tested the wire before heating it we should probably find it pretty hard, whereas after being heated and allowed to cool it shows itself considerably softer. The heat deprives it of its “temper,” in short; and it is well to know this, as by softening the metal by heating it and allowing it to cool slowly before filing or turning it we may greatly reduce our labour. To restore the hardness and rigidity it is only necessary to heat the iron once more, and plunge it while red hot into cold water. If after bringing the metal to such shape as we may desire we wish to smooth and polish its surface, we first use a rough file, then a finer, and finish off with emery paper.

Taking two pieces of wire similar to that we have been using we will now essay another experiment, which will reveal an additional and most important property of iron. Putting the pieces into the fire we bring them to a white heat, and then with the hammer flatten out successively one end of each piece. Returning the pieces to the fire, we keep them there until they reach a bright white heat, and throw off sparks when moved. This degree of heat is called the welding point. We draw them forth together, and placing the flattened end of one piece on the flattened end of the other, give them a few smart blows. This will cause the two pieces to unite, and we may by a judicious use of the hammer round off the joint so that it shall not be discernible.

Steel, owing to its hardness, is very difficult to work; but fortunately the amateur mechanic is not likely to require to do more with this metal than fashion flat bands or wires of it into springs, and this he will be quite equal to accomplishing.

Copper and its alloys are so useful for many purposes that they are practically invaluable. Pure copper is moderately hard, malleable, and tough. It is consequently easily shaped by hammering and filing. Copper wire is a most useful article to the amateur mechanic, and he will have many occasions for using it. A conspicuous advantage which copper wire has over iron is its greater power of resisting the action of the atmosphere. The oxygen of the air readily attacks iron, and produces what we call rust—in chemical language oxide of iron; but copper, though it may become discoloured, does not corrode rapidly.

The best known alloy of copper is brass, which is made in many qualities, varying with the proportions of copper and zinc used. Common brass is composed of three parts of copper and one of zinc. Two parts of copper and one of zinc make a very tough metal, and it is from it that brass wire is drawn. Clockwork and many small machines are made of brass, and it is the principal material employed in model steam engines, &c. It is easy to work, and takes a beautiful polish.

Zinc in the sheet form will prove useful for many of the purposes of the amateur mechanician. It is not easy to work because of its springy nature, but

it may be conquered by perseverance. It is strong and light, and well adapted for making the frames of small conservatories, aquaria, and the like.



Fig. 52.—ANVIL.

Tin and lead will also come in handily at times. Lead is easily shaped, and when it is desired to make a pattern of any piece of mechanism nothing could be better. Of course it is easily bent, and has no great strength, but still it will prove substantial enough for testing the form and size of pinions, cranks, &c. Lead with a small proportion of antimony blended with it makes a hard and somewhat brittle alloy known as type-metal. This is used, as its name implies, in making the types used by printers. The amateur founder will find this a serviceable material, and he may use it in making parts of mechanical models.

Four parts of lead to one of antimony give a moderately hard metal. The hardness may be increased by enlarging the proportion of antimony.

THE AMATEUR METAL-WORKER'S APPLIANCES.

Having thus briefly described the metals with which the amateur mechanic is likely to have to deal, we shall now enumerate and describe the tools he will require at the outset of his operations. We shall presume that he is the same person who has been under our guidance since the opening of "The Workshop," and that he is provided with the bench and wood-working tools we have called into requisition. The first tools which a worker in metals is sure to find necessary are a bench vice, a hand vice, an anvil, and a set of files. A vice sufficiently large, and that may be attached to the rear end of the bench (Fig. 54), may be bought for 7s. 6d. None of the pieces of metal we shall have to deal with in the course of our lessons will be large, and some of them will be so small, and will require such special treatment, that a hand vice will be required to hold them. The latter tool is of great use to metal-workers generally, but especially to model makers and other executors of small work (Fig. 53). It may be purchased for 3s.



Fig. 53.—HAND VICE.

With regard to files, we need not lay in more than half-a-dozen, and none of these will require to be large. Let us procure the following—one three-cornered file about four inches in length, one flat file not more than one-sixteenth of an inch thick, one half-round file about six inches long, and another nine inches, one knife-edged tapered file, and one small "rifler" or curved file. These may be bought for from 7d. to 1s. each. An anvil with a horn at each end (Fig. 52) will not cost more than 3s., and it will not be difficult to get a tree stump to form a stand for it. A smaller anvil, that may be fixed in the bench vice, will also be useful.

Fig. 54.—BENCH VICE.

The tools enumerated are, as we have said, the first essentials of a metal-worker; but there is a number of others which will come into requisition, perhaps less frequently, but which it is, nevertheless, desirable to have. We will mention a few of these. For holding very small pieces of metal and twisting wire a pair of pliers are most serviceable. Pliers (Fig. 55) are made with flat or round "noses," as the gripping part is called, and one of each kind should be

added to our stock. They will not cost more than a shilling each. As we proceed we shall have to bore holes in iron, brass, &c., and for that purpose will require a drill. There are various forms of this implement, and our choice falls upon the Archimedean (Fig. 56). This is a bar of metal grooved spirally, and terminating at one end in a flat knob or head, and in the other having an aperture in which to fix the drill. It is made to rotate by drawing backward and forward on the shank a "runner" fitted to the grooves. This tool is simple and convenient, and a decided improvement on the bow drill, in which the rotary motion is obtained by drawing a string fixed in a bow to and fro upon a bobbin. In fitting up metal models both rivets and screws are employed. For making the latter it is necessary to possess

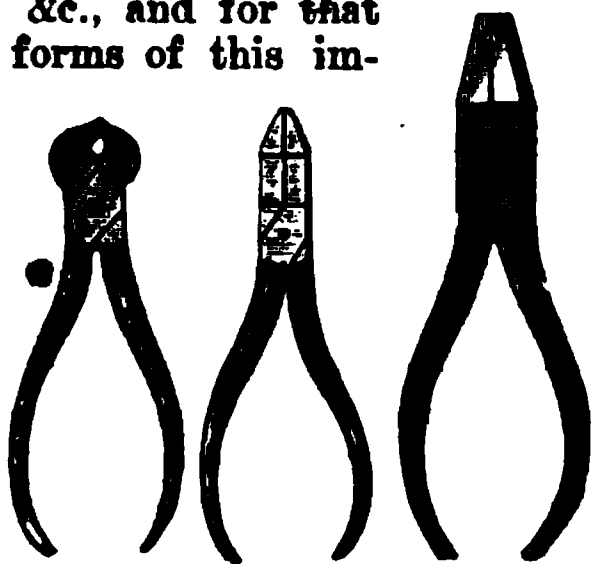


Fig. 55.- PLIERS.

a screw-plate and set of taps. The plate is for forming the threads on the screws, and the taps for making the threads in the holes designed for the screws. A complete set of this apparatus, capable of making five different sizes of threads, can be bought for 7s. 6d. A few tools for turning metals may be added, the lathe being already in our possession.

This may be considered a somewhat formidable list, but the tools will be sure to afford gratification, as they make such a variety of work possible.

HOW TO MAKE WIRE CHAINS.

A simple exercise to begin metal-working with is to form chains of iron, copper, or brass wire. Chains such as any ingenious youth may make will be found useful for many purposes. There are two forms of links available—the common oval link and the figure 8 (Fig. 57). To make these we require only the pliers. For a small oval-linked chain, such as Dutch clocks are fitted with, we use either brass or iron wire of the same size as the body of a rather stout pin. The wire should not be too soft, nor should it be springy, else in the one case the links will open readily to a slight strain, and in the other there will be difficulty in getting the ends brought together neatly. Cutting from the coil a piece of wire three-quarters of an inch in length, we turn up both its ends until we give it the form of a letter C with the horns rather elongated and standing out to the front; we then seize the link so far formed with the

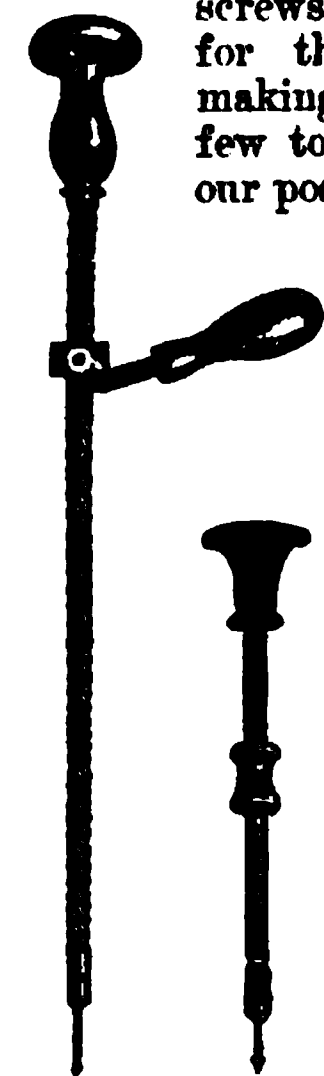


Fig. 56.- DRILLS.

pliers, placing one nose against the rounded back of the C, and the other upon the horns. With the pliers in this position, a slight squeeze will suffice to bring the horns inward, and complete the link. In making the succeeding links we must, before pressing down the horns, pass each link on to the one previously formed, and so unite them together to form our chain.

The figure 8 link differs from that we have described, in that it is virtually two links combined, one of which lies at right-angles to the other. A chain of this kind can be made much more rapidly than the other, if a suitable pair of pliers

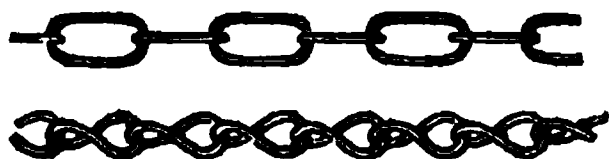


Fig. 57.—PIECES OF CHAIN.

be used. The pliers best suited for this work are those having a small rounded nose and a cutting attachment.

HOW TO MAKE A BIRDCAGE.

As we have wire in hand we may as well describe how a bird's cage (Fig. 58) is made, though doing so will render necessary the introduction of some joinery. The latter, however, is of a very simple kind. Say our cage is to be a foot square, a foot high, and to have the wires gathered dome-like into a central circular block, we shall require the following pieces of wood, which may be mahogany:—Four pieces for the corners, each a foot in length and half an inch square; four pieces for the lower rails eleven inches long, three-eighths of an inch thick, and two inches broad, except one piece for the front, which, as it will have to admit the false bottom or tray, must be an inch and a half wide only; for the middle and top rails we shall require eight pieces eleven inches in length and three-eighths of an inch square; and the central block or crown may be three-quarters of an inch thick, four inches in diameter, and may be turned according to fancy.

Fig. 58.—BIRDCAGE.

With a bradawl of the thickness of the wire to be used we must now bore holes half an inch apart in all the rails, those in the middle and upper rails to be pierced through, and those in the lower rails to have a depth of half an inch. The positions of the holes should be carefully marked off with compasses before beginning to bore. A quick mode of proceeding is to measure off and mark one of the upper rails, and then laying the others of the same size side by side with this, and, with the square to guide us, drawing a slight pencil line across all. A similar line drawn along the centre of each piece longitudinally will furnish all the guidance necessary for exact boring. The lower rails may be marked off in the same way. When all the holes are bored we may put the frame of the cage together. As a preliminary to this operation, however, we must measure and mark off the position which the rails are to occupy. Then taking one of the corner pieces and a lower rail, we set the latter on end and adjust the corner piece, and fasten it with a couple of inch brads, for the reception of which we first bore holes in convenient positions. Reversing the rail, we fix a second corner piece to the other end. The middle and upper rails are then inserted and secured with one nail at each end. Having put together two pieces or sides in this way, we proceed to connect them by inserting the remaining sets of rails. In fixing these the position of the nails already driven through the corner pieces should be observed, so that the worker may keep clear of them.

Our cage is now in frame, but it seems, and really is, a feeble structure. The addition of the bottom will give it stability, and we next prepare a piece of fir a quarter of an inch thick for that part. The bottom may be fixed with half-inch brads, and in driving these the upper part of the lower rails should be rested upon the corner of the bench or other suitable projection, so as not to throw the duty of resisting the blows of the hammer upon the rails at the extremities.

The front of the cage is that where the narrow lower rail has been placed. One end of that rail should have a small piece cut out of it to admit the seed drawer. The latter should be an inch and a half in width, an inch deep, and long enough to reach across the interior of the cage. It may be made of thin wood, its front end corresponding with and fitting nicely into the aperture in the front

rail. To prevent the birds from scattering the seed about, a shield is placed over the drawer. This consists of a side and top piece fixed across the end of the cage, the top piece being perforated with five or six holes an inch in diameter. The tray should be rather thinner than the bottom, and have a piece along its front edge corresponding in size to the part between the bottom and the lower edge of the rail.

In the crown piece there must be as many holes as there will be wires in the four sides, and these should be bored at equal distances apart to a depth of half an inch. The crown should terminate in a point and be furnished with a ring for suspending the cage. The frame and outer edge of the tray should be varnished at this stage.

All is now ready for wiring. The wire is purchased in hanks or coils, and opening out one end we straighten a portion about a foot in length, and pass it downward through the top and middle rails in succession, and into the corresponding hole in the lower rail. Judging by the eye how much to allow for the top curve, we detach the piece from the coil. Having inserted four wires in this way at opposite angles of the cage, we must adjust the crown to these, taking care that it falls in the centre, and that the wires have an equal curve. Now we may go straightaway with the wiring until we complete it. For a space of four inches in width in the centre of the front we leave an opening for the door by making the wires terminate at the middle rail. The door is simply a grating, composed of a series of short wires fixed in top and bottom pieces of wood of similar thickness with the upper rails. It is hinged by passing the long wire which bounds the door on one side down through suitable holes near the extremity of the door rails. The door may be fastened with a small swivel latch attached to the lower rail.

HOW TO MAKE A WIRE FLOWER-BASKET.

Among other articles that may be made of wire are hanging flower-baskets, and we may next try to fashion one of these. We shall require in the first place a dozen or fifteen yards of wire, with a diameter equal to the thickness of a penny. From this we cut a portion sufficiently long to make a hoop six inches in diameter. The hoop is formed by overlapping the ends of the wire, and tying them round with fine wire of the same metal. A second hoop eight inches in diameter is made in the same way. Across the smaller hoop we form a network with wire about half the thickness of that in the hoop. The network is made by cutting pieces of wire of suitable length, and looping their extremities on to the ring—one set of such wires crossing at right angles to another. We must cut eighteen pieces of the thickest wire, each fourteen inches in length, and after forming a small loop on each end—leaving the loop sufficiently open, however, to admit of its being slipped on to the ring which we have filled with network—bend each piece into the form of a letter U. These bent pieces or staples are then to be uniformly bent on the flat, so that when set upward upon their looped ends they shall present a graceful curve.

The pieces thus prepared are now to be taken and attached to the smaller ring in such a manner that they shall interlace, as shown in the engraving (Fig. 59). As the loops are slipped on to the ring they are squeezed with the pliers and made fast. The second ring that we have prepared is now slipped over the bottom of

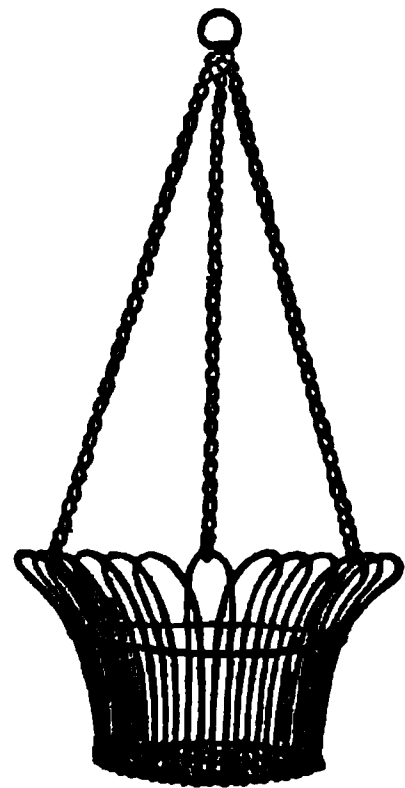


Fig. 59.—WIRE FLOWER-BASKET.

the basket, for so we may speak of it by this time, and pushed to a position fully half way from the bottom. Here it is to be laced to all the staples by a thin wire. We may now curve the loops of the staples still farther outward until we have obtained an agreeable outline. Three half-yards of chain with which to suspend the basket are now all that we require, and we may either make or purchase it. If made of galvanized iron our basket will require no preventive of rust, but if of common iron wire we shall have to paint it.

HOW TO MAKE A CRAB WINCH.

But our pupil may be wearying to have some lessons in which he will have to operate in a greater variety of ways upon the metals he deals with. To gratify his desire we shall now undertake the construction of a simple piece of mechanism. In connection with buildings in progress, in wood and stone-yards, and in docks, a compact hoisting machine may have been seen in use. This is the "crab winch." Winch is the name of various appliances for hoisting weights, and the special designation applied in the case we have in view is intended to indicate the crab-like resistance which the winch offers to the strain put upon it, this

resistance depending upon anchors sunk in the earth or upon weights placed on the beams to which the winch is attached.

In approaching a piece of work like this we must prepare drawings according to a scale. Suppose we take here the proportion of an inch to the foot; that is, what is represented in a winch of full size by a measurement of a foot shall in our model be represented by a measurement of an inch. The machine we wish

Fig. 60.—CRAB WINCH.

to construct is shown in Fig. 60. It will be noted that it consists of a platform, two standards or cheek pieces, three rods binding these together and supporting them, an axle and a cylinder, the former having a pinion or small wheel near one of its ends, and the latter a large toothed wheel. The axle is continued through the standards to the outside, and on the extremities thus presented handles are fixed.

We shall make the standards first. These are formed of cast iron in large winches. Type-metal will serve our purpose very well, and it is quite within our range to do a little foundry work in that material. The standards are shaped like the letter A, and as they are identical we shall have to prepare only one model or mould for casting them. This we may cut in wood, for the type-metal cools rapidly, and before it can char the mould. We shall not attempt to make a raised rim along the outline of the standards like that which is usually seen in the full-sized machine, but content ourselves by giving them a flat surface. Preparing a piece of mahogany three-sixteenths of an inch thick and about six inches square, we draw an outline of one of the standards upon it, and cut out the portion thus indicated. The piece representing the aperture above the cross-bar will of course be detached by this operation, but we must preserve it. The piece of perforated wood we now nail down upon the smooth surface of a piece of deal, placing the loose piece we have referred to in its position, and fixing it

there. It will be seen now that we have a mould corresponding to the form and size of one of the standards. On this we place a third piece of board having a smooth surface beneath and fix it thus, but not before we have bored a hole through it leading down to the mould.

Now we take five parts of lead (ten ounces) and one part of antimony (two ounces), and melt them in an iron ladle furnished with a lip or spout. When the metal is thoroughly fused, we pour it through the hole referred to until it overflows at the top. In a few minutes we may remove the upper board, and extract the casting, which will have the appearance of silver. We then proceed to cast the second standard in the same way. If the mould has been carefully made, the castings will require little dressing, but it will improve their appearance if we file down the angles and round them slightly. This, however, must not be done to the angles of the bases or feet of the standards, which should be left sharp, so as to fit closely to the platform.

Holes have next to be drilled through each standard in the positions indicated—one for the axle of the driving pinion, one for the axle of the drum, three for the stay-rods, and two through each projecting foot for fixing them to the platform. The axles in large cranes are furnished with brass bearings, but these we may dispense with here, and allow the type-metal to take the friction. Iron wire one-eighth of an inch in diameter will do for the stays. The internal width—that is, the distance between the standards—is to be three inches, and we may cut pieces three inches and three-quarters in length for the stays. Leaving a space in the centre of each exactly three inches in length, we file down the ends—it would be rather troublesome to turn wire of such small diameter on our lathe

—to about half the diameter, so as to leave shoulders for the support of the standards.

Our die-stock and taps (Figs. 61, 62) now come into requisition,



Fig. 61. - DIE-STOCK.



Fig. 62. - TAP.

and we work a screw-thread on each end of each of the stays, and selecting a corresponding tap, use it to make a set of nuts for the ends of the stays thus prepared. The nuts may be made from a slip of brass one-sixteenth of an inch in thickness. While the brass is still in the form of a slip, we drill a hole through it for each nut required, leaving a sufficient distance between for the shaping of the nuts. The drill used should be slightly smaller than the diameter of the screws, so that there may be metal sufficient left for the formation of the threads with the tap. In drilling the holes the best way to proceed is to place the slip of brass against a piece of wood, and fix both in an upright position in the vice. This leaves both hands free, as is necessary, to work the drill. The tapping may be done by fixing the slip of brass in a horizontal position across the vice, with one of its flat sides uppermost, and applying the tap to the holes in succession. The nuts may then be shaped with a three-cornered file, and detached. They will look best if made of octagonal form.

The parts thus prepared should be put aside till required, when the work is ready to be put together. A small wooden bowl, which our pupil may easily make on his lathe, is a useful receptacle for parts of jobs in progress. We may next take in hand the cylinder and its large wheel, in connection with which we shall have an opportunity for doing some neat work. The cylinder we will make of a piece of mahogany about half an inch in diameter, and 2½ inches in length. This we fashion in the lathe, observing to cut at each end of it a narrower part, about one-eighth of an inch in length, on which to place ferrules. The ferrules or rings are cut from a piece of brass pipe of corresponding diameter, and, having driven them on, we finish off the work in the lathe. If this part be carefully

executed, it will much enhance the appearance of the crane when completed. Through the centre of the cylinder longitudinally we have to bore a hole for the passage of the axle. For the latter a piece of wire of the same or slightly larger diameter than the stay-rods will be required. It must fit very tightly into the cylinder, so that the latter shall not revolve upon it, but be carried round by it.

As the distance between the holes or bearings of the axle of the driving pinion and that of the cylinder wheel is one inch and an eighth, the large wheel will have to be two inches in diameter, the pinion being three-eighths. The large wheel, which it would be desirable to purchase ready-made, need not be more than one-sixteenth of an inch in thickness. It should fit tightly upon the axle, and be driven close to the end of the cylinder, and fastened to it by a couple of nails, holes for which should be previously bored through the wheel. Outside the wheel a small disc of brass should be fixed, which will at once have the effect of steadying the wheel and keeping it from coming into contact with the standard. The axle beyond this disc and at the other extremity should be slightly reduced by turning.

The pinion we may make ourselves. Its thickness may be twice that of the large wheel. Selecting a suitable piece of brass, we draw a compass-line marking its circumference, and divide it into teeth. We then drill a hole in it one-eighth of an inch in diameter. Fixing the piece thus prepared in the vice, we file it down to the compass-line, taking care to leave a clean rectangular edge. Then with a suitable file we cut out the teeth. In laying off the teeth before cutting we must ascertain by measurement how many teeth of similar size to those on the large wheel the pinion will accommodate, and act accordingly. Perhaps we may find, if the teeth are large, that the pinion will not carry more than six, but eight is a common number. The pinion has to fit tightly to its axle, and be forced on. As the pinion axle has to carry the handles of the crane, it is not desirable to reduce the ends much. They may, however, be thinned slightly, so as to form a shoulder for the support of a washer at each end just inside the standards. These washers will prevent the axle from slipping about laterally. But first there should be put upon the spare end of the axle a ratchet-



FIG. 63.—RATCHET-WHEEL & PAUL.

wheel, to prevent the cylinder from unwinding in the event of any slip at the handles. This wheel may be made of brass in the same way as the pinion. Its form, and the "pawl" which accompanies it, are shown in Fig. 63. So long as the handles are turned steadily forward, the pawl slips over the teeth of the ratchet; but the moment the pressure is taken off the handles, and the cylinder in consequence tends to fly back, the strain is taken by the pawl, and retrograde motion prevented. This ingenious but simple appliance is extensively used in mechanism.

The extremities of the pinion axle should have screws formed on them to receive the handles.

All the parts of the crane are now made, and we may proceed to put them together. The stays are first passed through and fixed in one of the standards. Then the ends of the drum and pinion axles are inserted in the same standard. Taking up the second standard, we now enter all the stays and axles into their respective holes, press the standard home, and fix the nuts on the stays. We next prepare a platform, which may be of mahogany, and of the form shown in the engraving (Fig. 60). In a central position on this we set up the crane, and either with screws or nails passed through the projecting foot-piece, fix it there. Handles, with which to work the crane, have yet to be provided. These we fashion from pieces of brass wire about one-eighth of an inch in diameter, and two inches in length. Flattening one end of each piece, we bore a hole through it, and tap it to fit the end of the pinion-axle on which it is to be fixed. We then bend each

piece to a rectangular form, giving to the limbs an equal length. Here there is room for some neat work with the file in shaping the handles.

The action of the crane may be tested by attaching a cord to a small hook provided for the purpose near one end of the cylinder, but not previously mentioned. This cord should be led through an overhead pulley, and have a weight attached to it. If we now turn the handle we shall see the weight rise, very slowly it is true, because we have to sacrifice time to gain power. We have to make about a dozen turns of the handle in order to get one revolution of the cylinder on which the cord is wound; but then we are able to raise a weight a corresponding number of times heavier than we could do with a similar expenditure of strength without the aid of the machine.

HOW TO MAKE A WINDMILL.

Windmills are familiar objects to the eye in most parts of the country; but probably few of our readers have taken the trouble to go inside one of these picturesque structures to ascertain the principle of its action. Wind and water are the only natural agents that are directly employed for motive purposes. From the former we derive motion by exposing to it the sails of ships and windmills, and from the latter by obstructing its flow with bucket-wheels or turbines. The difference between a ship and a windmill, as regards the action of the wind, is that, while the ship moves onward through the water under the pressure imparted to her sails, the windmill is stationary, and the wind pressing upon its sails causes them to revolve, and so communicate motion to the machinery.

A windmill consists of a tall building in the shape of a truncated cone, a revolving cap, a set of sails, and the grinding or other machinery, according to the purpose for which it has been erected. With this general idea before us, let us proceed to make a model windmill, on a scale of half an inch to the foot (Fig. 64). For convenience of moving, we shall build upon a base formed of a piece of deal one foot square and one inch in thickness. The tower, or main body of the mill, will be octagonal in form, twelve inches high, eight inches in diameter at the bottom, tapering to six inches at the top. For its construction we shall require some pieces of deal half an inch thick, to form standards or vertical beams in each angle, and other pieces a quarter of an inch thick to form the walls.

Fig. 64.—WINDMILL.

The standards we shall make an inch in width and half an inch in thickness, bevelling one side to the right and left, to fit the angle at which the sides will meet. As a portion of the standards, half an inch in length, will be sunk into the platform to give stability, we must make them twelve inches and a half in length. The lower ends may be inserted into the platform in the form they bear after being bevelled, or they may have tenons formed upon them. The former is the simpler plan, and we shall adopt it. Having drawn on the platform a full-sized outline of the base of the tower, we draw another line a quarter of an inch within that, in order to show where the inner surface of the sides will extend to. In each

angle within the inmost line we then draw lines corresponding to the section of the standards, and, thus guided, cut mortices or apertures to receive the ends of the latter. Before fixing the standards we must prepare a piece of board a quarter of an inch in thickness to nail on the top of the standards, and form, as it were, a floor for the upper part of the mill. This board will have to be five inches and a half in diameter, and octagonal in form, of course, and a hole three-eighths of an inch in diameter has to be bored through its centre.

We may now proceed to fix the standards, by gluing them in their sockets and nailing the covering-piece upon their upper ends. That done, the wood for the sides may be taken in hand, and dressed and shaped with the plane, care being taken to bring them to fit nicely at the angles. In what is to be the front side we now cut a door, three inches in height and one inch and a half in width, and at equal distances over this aperture, window openings, measuring two inches by one, may be formed. There should also be two windows in the back. The side pieces—all except those for the front and the back—may be glued on as soon as ready; but the two pieces mentioned will have to be left unfixed in the meantime, so as to give access to the interior in setting up the mechanism. When the glue has dried, a few small brads may be used to strengthen the attachment of the side pieces to the standards.

We must now consider to what use our mill is to be applied. Suppose we elect to fit it for grinding. As we could not make a model on the scale we have adopted that would actually reduce corn to meal, we shall not attempt more than the production of what will so far be a copy of a real mill that it shall have sails that will revolve on exposure to the wind, and mechanism that will convey the motion so obtained to the upper millstone and cause it to run round. To represent the millstones, we make in the lathe two discs of sycamore, each two inches in diameter and three-eighths of an inch thick. The nether millstone, as the lower of the pair is called, is fixed, and we glue our representative disc down upon the middle of the floor, having first bored a hole one-eighth of an inch in diameter through its centre. The other has to be fixed upon the end of an iron rod or shaft, which extends downward from a little distance above the upper floor.

This shaft we may fashion from a piece of carefully straightened iron wire a quarter of an inch thick. What is to be its lower end we turn down to a diameter of one-eighth of an inch, for a length of three-eighths of an inch. This is to fit into the hole in the centre of the nether millstone. Just above this reduced part the upper millstone has to be fixed firmly upon the shaft, so that it may be carried round by it.

On the upper end of the shaft a bevelled pinion made of brass or hard wood will have to be fixed, to gear with a corresponding wheel on the axle of the sails. For the reception of the pinion a small part of the extremity of the shaft has to be reduced in diameter. The pinion and wheel may be made by an ingenious amateur; but if it is desired to have them of brass it will be best to purchase them from a clockmaker or dealer in mechanical toys. To steady the shaft and keep it in a central position a small groove should be cut into it on the lathe at a point on the level of the floor, and two slips of brass may be fitted to this groove, so as to clasp the shaft like a collar. These slips should be tacked down to the floor when finally adjusted.

As the wind can never be reckoned upon to blow long in any particular direction, windmill builders have to adapt themselves to the fickle agent, and so construct their sails that they may be turned to the wind no matter from what quarter it may be blowing. This they do by an arrangement known as a revolving cap. This cap is mounted on the top of the main building, and is fitted with wheels which run on a circular rail, so that it may turn round readily. To exclude rain the cap is made of larger diameter than the top of the tower, and overlaps it

to some extent. We shall give our cap a diameter of seven inches and a half, and a height of four inches, and allow it to overlap the tower to a depth of half an inch. Like the tower, the cap will be octagonal in plan. Its sides will be three inches in height, and from them the roof will rise to a centre one inch higher. Having prepared eight pieces of quarter-inch deal for the sides, we make a corresponding number of blocks for the angles similar in form to the standards on the tower. The blocks, however, must be only one inch and a quarter in length, as they must not extend downward in the rim of the cap which overlaps the tower.

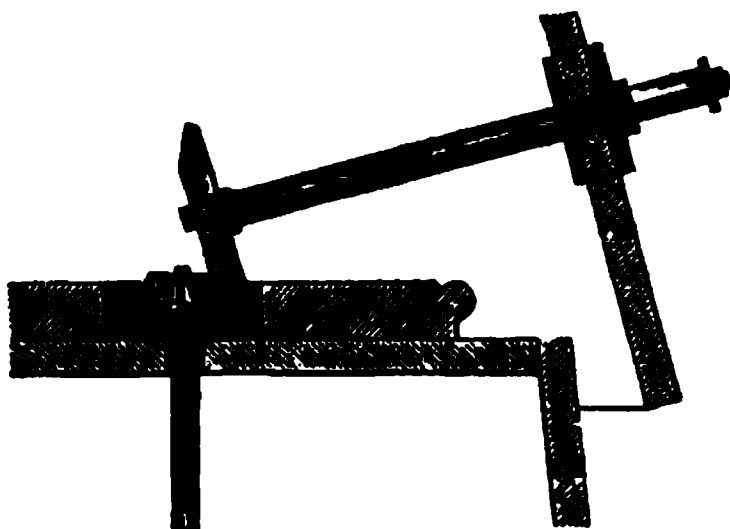


Fig. 65.—GEARING OF SAIL AND AXLE.

After fixing the sides of the cap together, and before putting on the roof, we must make and put into position the axle of the sails and its attachments. In Fig. 65 are shown the top of the upright shaft with its pinion, and the axle and driving wheel of the sails. It will be noted that the axle is not horizontal, but that its outer end is raised slightly. This is to bring it to right angles with the sail-arms, which are constructed so that their faces will be about eighteen degrees from the perpendicular. This backward slope is found by experience to have several advantages. The sails catch the wind better, and the strain upon the tower and machinery is less than if the arms were perpendicular.

The axle may be made of brass, and its construction will give us an opportunity for a lesson in metal turning. Already we have mentioned the cutting of a small groove in the upright shaft, and did not stop then to explain how it was to be done. We require to add to our lathe equipment several appliances which were not necessary in dealing with wood, and these we had better describe here. In turning metal rods, &c., it is usual to fix the work between two points. When turning wood we used only one point—that in the movable head stock—the place of the second being taken by the chuck. We require, then, a steel point to take the place of the chuck. In order to provide a grip for the points we must, with a punch, form a small indentation in the centre of each end of the piece of metal to be turned. Having proceeded thus far it will occur to our pupil to ask how the

work is to be made to rotate when merely suspended between two points. We shall explain. A "carrier" (Fig. 66) is required. This is passed over one end of the work, and fastened to it by means of the screw. Against the carrier a "driver" attached to the mandril of the lathe presses and carries it round. There are various forms of carriers, and different modes of applying them for special work. When a long slender rod of metal has to be dealt with, the "back-stay" is brought into requisition. This is a piece of wood set upright and fixed in the bed of the machine. It has a projecting arm of hard wood with a groove in its extremity, and capable of

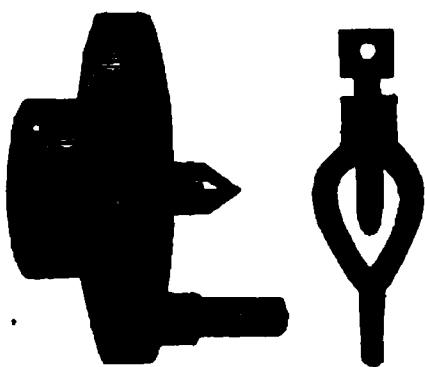


Fig. 66.—DRIVER AND CARRIER.

adjustment in a line backward and forward. The back-stay is set up near the middle of the rod to be turned, and the groove in its arm is brought forward so as to support the rod and prevent its bending away from the pressure of the turning tool. The turning tools used for metals are different from those required for operating upon wood, and are known as "gravers" and "heel-tools." They remove only a small portion of material at a time.

As regards the shaft, we may put it on the lathe and in a very brief space cut the groove for the collar bearing to which we have referred. We may also reduce its extremities to fit the pinion and the hole in the nether millstone respectively, as we shall be able to make more exact work than we could do with the file. The axle for the sails is a more elaborate job. We shall require for it a piece of soft brass fully four inches in length and three-eighths of an inch in diameter. This we shall have to reduce to

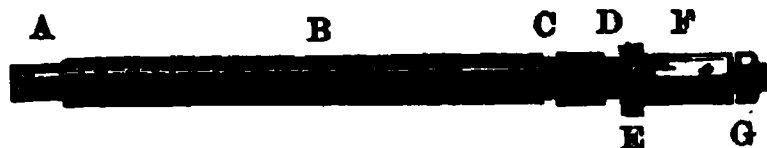


Fig. 67.—AXLE FOR SAIL.

the form shown in Fig. 67, where A is the extremity reduced to receive the driving wheel, B the body of the axle, C a groove for bearings to be fixed inside the wall of the cap, D a similar groove for bearings to be fixed on the outside of the cap, E a collar to take the pressure

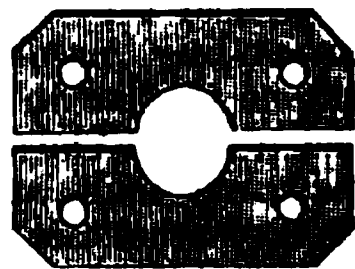


Fig. 68.—BEARING FOR AXLE OF SAIL.

of the sails and steady the axle, F a squared piece on which the sail-arms will be fixed, and G a projecting point of the same, which will be screwed to receive a nut. The grooves may be cut with a turning graver having a face like a tiny chisel. The bearings for the axle, like those of the shaft, may be made of brass, about the thickness of a penny piece. Each bearing will consist of two pieces, as in Fig. 68. Of course, it is necessary to proceed in all this work by very exact measurement; otherwise the whole labour may be marred by a misfit.

Before mounting the axle and its fittings, we must provide for the cap revolving readily and without danger of being blown off. With this object we turn a disc of sycamore four inches and a half in diameter and half an inch thick, and give its edge the form shown in Fig. 69. The centre of the disc must be bored or turned out, to afford room for the shaft head and pinion. An aperture an inch in diameter will suffice. Four grooved wheels, like C, have next to be provided. These may be of sycamore, three-quarters of an inch in diameter and a quarter of an inch thick, the edges to be grooved to a half-circle. Four forked pieces of wood, in which to mount these wheels, have also to be made in the form shown (B). The forked pieces are to be fitted and attached to four of the angle blocks of the cap at equal distances apart.

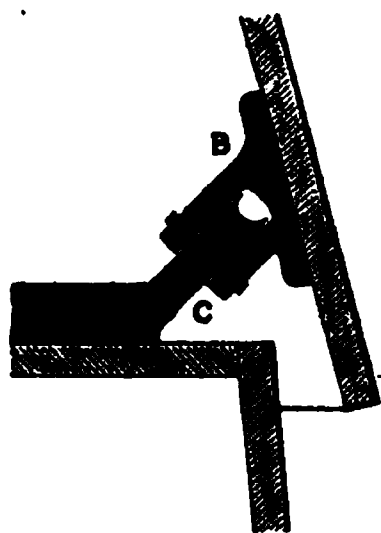


Fig. 69.—BEARING FOR CAP OF MILL.

The axle and wheel may now be mounted on the cap, and the latter put in position. As the grooved wheels are intended to under-clasp the rim of the disc or rail on which they are to run, all of them cannot be fixed in the forks until the cap is put into its place. In making the forked pieces a careful measurement must be made, so that the grooved wheels may run easily without having too much play. The roof, which may be constructed in the same way as the sides, may be made at this stage, or left until the sails have been mounted. In any case it will be



Fig. 70.—SAIL FRAME.

movable, in order to give access to the machinery. Its apex may be adorned with a wooden spike or finial, formed on the lathe.

The sails will next occupy our attention, but it may be well to paint the mill before proceeding farther. For the sail arms we require two pieces of

even-grained pine, twenty inches in length, half an inch in breadth, and a quarter of an inch in thickness. In the centre of each piece we cut a square hole to fit on to the squared end of the axle provided for them. On one side of each arm is then to be constructed a frame of similar wood, but only one-eighth of an inch in thickness, as shown in Fig. 70. On each of the frames thus formed a piece of calico is to be sewn, being well stretched, so as to remain as flat as possible. The two pieces thus equipped are then to be nailed together at right angles, and fixed upon the axle by means of a nut fitted to the screwed tip.

An important accessory of a windmill, that we have not yet mentioned, is the vane, or rudder, which keeps the sails facing the wind, no matter from what direction it may blow. This vane is simply a windmill, which, when the wind blows directly upon it, revolves, and as it does so turns a shaft, which, acting upon a wheel inside the cap, causes the latter to turn round until the large sails face the wind. To make this part would be such an addition to our work that it would be apt to tire, and we omit it, contenting ourselves with an arrangement whereby, when the sails are turned to the wind with the hand, they may be held in that position by a peg fixed in some part of the cap. With this explanation we may now put our mill to a practical test, by exposing it to the wind, and the pupil who has persevered to the end will have the satisfaction of seeing the sails go round, and all the other parts in motion.

The windmill may be readily adapted to driving a model circular saw or a pump, by placing a model of either on the platform and leading to them a belt from the upper millstone, which would thus be converted into a driving pulley.

ENGINEERING.

STEAM is the great worker of modern times. It transports the merchandise of the world by land and sea, and carries us to the remotest parts of the earth with a speed that must have appeared utterly unattainable even half a century ago. It drives our mills, pumps our mines, and in thousands of different ways ministers to our comfort.

The apparatus in which its force is made available is one of the most wonderful products of human ingenuity, and withal remarkably simple. Its chief part is the cylinder, with its piston. Steam flowing in at one end of the cylinder forces the piston to the other, and when it reaches that a similar process forces it back again. Speaking generally, this is all; but there are important details that have to be regarded in extracting from the steam a maximum of power in return for a minimum of fuel.

HOW TO MAKE HERO'S ÆOLIPILE.

Curiously enough, though the power of steam to impart motion through mechanical means was known many centuries ago, its utilisation for practical purposes is but a thing of yesterday. So early as the year 130 before Christ that ingenious person, Hero of Alexandria, devised a mode of obtaining mechanical motion from steam. The principle of the invention was simple in the extreme. A globular vessel with two curved tubes projected from opposite sides was balanced between two pivots, one beneath and the other above. Into the vessel some water was poured, and then a lighted lamp was placed beneath it. When the water boiled and gave off steam, the latter, issuing from the curved tubes and impinging upon the air, caused the vessel to spin round. As an introduction to our dealing with steam apparatus, we may make a model of Hero's engine (Fig. 71).

A common tin flask will do for our boiler, and we require only to make a stand for its support. Fixing a rod of wood about a foot in length

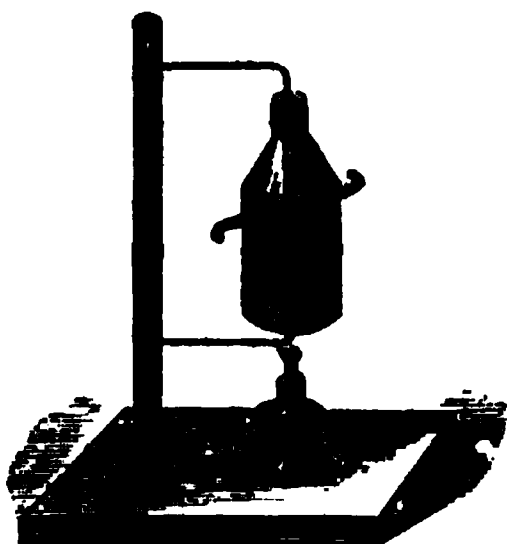


Fig. 71.—PRIMITIVE STEAM ENGINE.

and one inch square in an upright position upon a piece of board, we bore two holes in it at a convenient distance apart, and insert in these pieces of stout iron wire with their tips sharpened and turned upward and downward respectively, as shown in the figure. We now take our flask, and with a punch make a well-defined indentation in the centre of its lower end. This is for the under wire to rest in.

We then prepare a piece of small brass tubing of sufficient length to pass through the flask and project a couple of inches on either side. Just beneath the shoulder of the flask we bore a hole on each side, to admit of the pipe being passed through and through. The hole should be made as nearly the size of the pipe as possible. In the centre of the pipe we must file an aperture to allow the steam to enter. Having passed the pipe through the holes prepared for it until it projects equally on both sides, we apply a little solder, to ensure that the pipe fits closely and to hold it securely. How the soldering is to be done may be learned on consulting later pages (pp. 652-3), and we do not stop to explain it here. After being soldered the ends of the pipes have to be bent to a right angle.

Filling the flask half full of water, we cork it firmly, and then in the centre of the cork make a hollow for the reception of the tip of the upper wire. Placing the flask between the wires, we apply a lamp beneath it, and then patiently wait the result. When the water begins to boil and give off steam the latter flows through the tubes, and expanding in and pressing upon the atmosphere, re-acts upon the flask, lightly poised as it is, and causes it to revolve. If we have any model machine handy we may drive it by means of a belt passed round the neck of the flask.

HOW TO MAKE A MODEL HORIZONTAL ENGINE.

We might proceed to illustrate the development of the steam-engine by other models of early machines; but as this is not a treatise on the subject, we shall content ourselves with taking the engine in the forms in which it is now commonly used, and describe to our pupil how he may make models of some of them. Toy engines of all kinds may be purchased ready-made, or the parts may be bought separately and be put together by the amateur engineer. Many model steam-engines have been made out and out with the aid of only a few simple appliances, but at an enormous expenditure of time. The cylinder, with its steam-chest, is the most difficult part to master. It is usually cast in brass, and has to be bored out with great exactness. The other parts are more easily fashioned.

In Fig. 72 we have the simplest form of engine ever devised. It consists of a cylindrical boiler mounted on a tripod, and supporting an oscillating cylinder, crank, and fly-wheel. This tiny power generator may be purchased for half-a-crown. The cylinder is on a very ingenious plan, the apertures for the ingress and egress of the steam being concentrated at one point, and opened and closed by the oscillating of the cylinder on a pivot. The

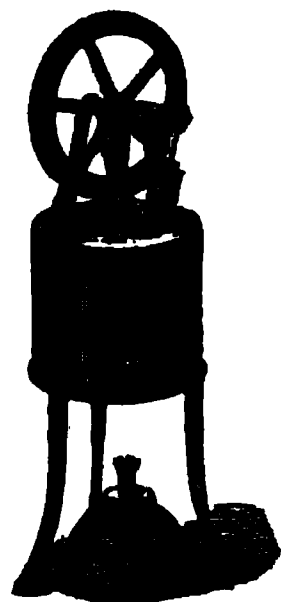


Fig. 72.—SIMPLEST FORM OF STEAM-ENGINE.

engine is what is known as direct-acting, that is, the piston-rod is attached directly to the crank of the fly-wheel without the intervention of a connecting-rod. If our pupil cares to make one of these machines he may readily do so; but we would advise him to bestow his labour upon an engine of more perfect design.

Here is a drawing of a horizontal high-pressure engine (Fig. 73), to the construction of which we shall apply ourselves. If our pupil will look carefully at this diagram we shall briefly explain its leading features and indicate how we are to proceed. The cylinder claims primary attention, as it is with it that the steam comes first into contact, and because it really is the heart of the whole machine. It consists of a cylindrical vessel, cast in brass for our model, but made of iron in the case of large engines. It has projecting flanges at the ends, and to these the cylinder covers are fastened with screws. On one side of the cylinder there is a longitudinal ridge, in which the steam-ports are formed. These consist of

FIG. 73.—HORIZONTAL HIGH-PRESSURE STEAM-ENGINE.

three apertures (A, B, and C in Fig. 74). The use of A and C is to conduct the steam through the channels indicated from the steam-chest into either end of the cylinder, while B is the escape-port, through which the steam issues after it has done its work in making the piston traverse the cylinder. Immediately over the steam-ports the steam-chest is fixed. It is a narrow elongated chamber, through which the steam has to pass on its way to the cylinder, and in which the slide-valve is situated. The use of the slide-valve is to couple the openings A and C with the escape-port alternately, so that while one is in direct communication with the steam-chest, and so allowing the steam to flow into its end of the cylinder, the other is discharging the exhausted steam from the opposite end through the escape-port. This is a beautiful device, and, with the condensing arrangement now attached to most stationary engines, constitutes the chief feature of Watts's invention. Our pupil will now understand that the steam is conducted by a pipe from the boiler to the steam-chest, and that it passes thence to the ends of the cylinder alternately through the ports controlled by the slide-valve. How the slide-valve is actuated we shall see farther on.

The piston, which is enclosed in the cylinder, and is moved to and fro by the action of the steam, is composed of two discs of metal fixed

a little distance apart on the end of a rod which passes through the head of the cylinder, and communicates its motion to the mechanism of the engine. In the space between the discs is the packing necessary to make the

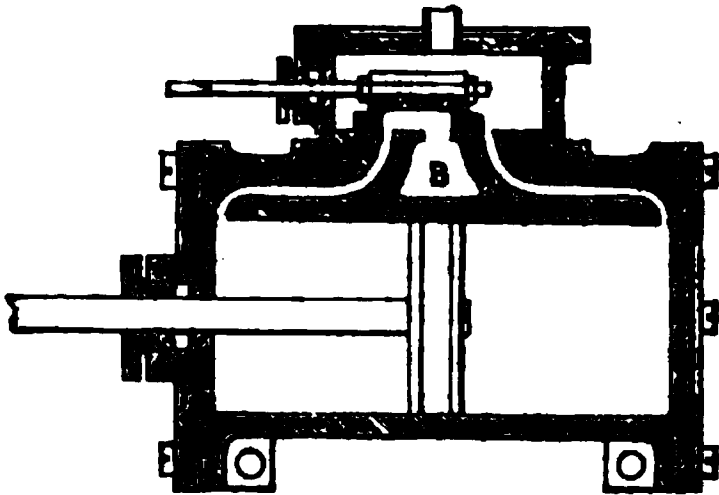


Fig. 74.—PLAN OF CYLINDER.

piston steam-tight. This packing is for the most part composed of steel rings made in sections, which, expanding outward, press against the interior of the cylinder, and so prevent the steam from passing the piston. In small engines a packing of specially prepared indiarubber or greased hemp is used. To obtain a rotary motion from the reciprocating action of the piston the connecting-rod is introduced, and operates upon a crank on the end of the axle which carries the fly-wheel. The latter is employed to reduce the jerking motion of the piston to a smooth and steady one. It will be understood that the pressure exerted on the crank by the piston through the agency of the connecting-rod is greater at some parts of its revolutions than at others. This inequality of momentum the fly-wheel takes up and distributes evenly. There are two "dead points" in the circuit which a crank traverses: one which it reaches when the reciprocating power which acts upon it is thrust out to its farthest, and the other when it is drawn home to the utmost. This may be illustrated by working with the hand a coffee-mill or grindstone, on the same conditions as to thrust and pull displayed in the steam-engine. Once the fly-wheel is set in motion it carries the crank over the dead points, and at the same time prevents the crank, when passing those parts of its circuit in which the power operates most effectively, from moving with a jerk.

The slide-valve and its gear may now be described. The valve has to be moved to and fro in sympathy with the motions of the piston. As has already been explained, the use of the slide-valve is to open and close the steam-ports alternately and conduct the exhausted steam to the escape-pipe. As the ports are concentrated in a central position the valve has to move but a short distance in either direction, and it derives its motion from an "eccentric."

This is a disc of metal fixed upon the axle of the fly-wheel, its true centre being, as its name implies, some distance aside of the centre of its attachment. Fig. 75 shows the form of the eccentric and its connecting-rod. By using an eccentric we are able to obtain from the circular motion of the crank shaft the reciprocating motion required in the slide-valve, so that we start from the cylinder with a reciprocating motion which we convert into a circular, and return to the steam-chest with a reciprocating derived from a circular motion. Now, if we suppose the mounting of the slide-valve to be complete we shall see how it operates.

The piston has reached what we may call the farthest end of the cylinder, thus completing one of its journeys, and simultaneously with that the slide-valve has moved along, leaving clear the connection between the port at that end and the steam-chest. Consequently, steam flows into the cylinder and forces the piston to the other end. While this has been going on the slide-valve has coupled the port at the end

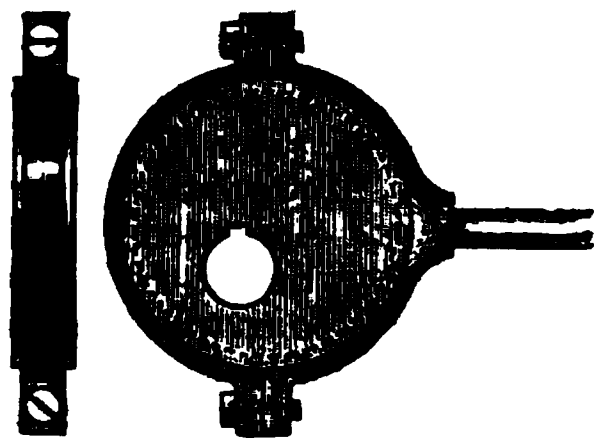


Fig. 75.—ECCENTRIC AND CONNECTING-ROD.

towards which the piston is travelling with the escape-port, and the steam flows out as the piston approaches. Nice adjustment of the respective movements is necessary to ensure the most harmonious production of these movements.

Thus, in a general way, we have stated how motion is derived from steam. There are various points of detail in the construction of the engine which we have purposely omitted in order to simplify matters; but these we shall fill in as we instruct our pupil how to construct such an engine as we have described. A puzzling part of the engine to the uninitiated is the governor. The two polished balls whirling away show no sign to the cursory observer of performing any office. They are, however, part of a device for obtaining steady work, their mission being to regulate the flow of steam into the steam-chest, and if they were absent the engine would increase its speed every time the fire was stirred, and slow down as the heat became reduced. The governor—or rather, we should say the form of governor we are dealing with, for there are now many varieties in use—acts upon the well-known law of centrifugal force. If the spindle to which the balls are attached revolves beyond a certain speed the balls will tend to fly outward, and in doing so they operate upon the hinged levers to which they are attached, and these in turn act upon a lever connected with the throttle-valve, and close the latter to a greater or less extent. The throttle-valve is placed in the pipe which leads the steam from the boiler to the cylinder, and consequently its motions determine the speed of the engine.

Concluding that we have got our pupil to understand the action of the steam-engine and the more prominent parts of its mechanism, we may now obtain our materials and proceed to construct a model engine on the principle described. But before starting it is necessary to offer a word of advice. There is a good deal of troublesome work to be done before our engine can be completed, and intelligent perseverance will be necessary in order to carry us to a satisfactory issue. Some expense must also be incurred. The pleasure which is to be our reward in undertaking a job of this kind lies almost as much in the work as in its result, and if we can keep that in view we shall get along nicely. We wish to exercise our constructive faculties and to practise the use of tools, not merely to possess a model engine. If the latter were the measure of our ambition, we might gratify it by purchasing an engine ready-made.

Few amateurs ever reach that degree of expertness, or rather, have at their command all the appliances requisite for making a steam-engine cylinder. This part of the engine is partly formed by casting, and finished by filing, turning, and boring. The interior has to be very exactly bored out, so as to ensure the piston being steam-tight. As this and all other portions of engines may be bought in a detached and partly finished state, we advise our pupil to purchase the cylinder. This, with the piston, steam-chest, and slide-valve, will cost about a guinea for an engine of the size we propose to make. Its internal measurement will be one inch by two inches and a quarter, so that it will give a two-inch stroke. Having procured it, we must next draw a full-sized plan of our engine, taking the cylinder as the basis for determining the size of all the other parts. The boundary of our plan will be the dimensions of the bed-plate on which the engine is to be built. This will be a parallelogram, measuring thirteen inches by five. Within half an inch of one end and the same distance from what we shall call the front edge of the plate we lay down the dimensions of our cylinder in outline, and from that set off the other parts of the engine. The centre of the fly-wheel shaft should be six inches from the extremity of the stuffing-box of the cylinder. Guided by this drawing as to the dimensions of the various portions of the

engine, we now proceed to draw these separately of their exact size. In Fig. 74 nearly all the parts we require are shown, and they are drawn to scale.

For the foundation of our engine we require a piece of mahogany fifteen inches in length, seven inches broad, and one inch thick. This we plane neatly, and bevel round the upper edge. The bed-plate which is to be erected upon this must be of brass, an eighth of an inch in thickness. Its other dimensions have already been given—namely, thirteen inches by five. To support the plate at a height of two inches and a half we require six pillars with screwed extremities, those at the lower end to screw into the wood and those at the upper to receive nuts. The pillars may be made of brass rod three quarters of an inch thick, and the turning and screwing of these will bring our lathe and some of our metal-working tools into requisition. For the reception of the top of the pillars the bed-plate will require to have holes drilled through it. Before fixing the plate, however, we have to cut holes in it for the fly-wheel and its

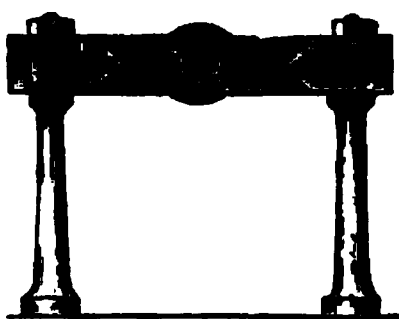


Fig. 76. — CROSS-HEAD.

crank to dip into. In order to find the true position for these we copy from the drawing we have already made, and scratch slightly upon the brass the central line of all the parts. This we shall find a great aid to that exact fitting of the pieces which is essential if we would have our model work satisfactorily. Our fly-wheel will be five inches and a half in diameter and one-quarter of an inch thick, and the hole to be made in the plate must be somewhat larger than these measurements—say six inches by half an inch.

Before fixing the cylinder in its position we must fit a cross-head to the piston-rod, and prepare it for attachment to the connecting-rod. As furnished by the maker, the extremity of the piston-rod is a plain round bar of iron, and it requires to be furnished with a cross-head to run in guides and support it in a true horizontal line. The cross-head may be made of brass, and attached to the rod by screwing it on. The ends of the cross-head have each a V-shaped notch to fit to the guides (Fig. 76). For the cross-head we select a piece of brass rod fully a quarter of an inch square, and of any convenient length. We require a portion only half an inch in length, but we shall be able to handle the metal more conveniently if we do not detach the portion we require until we have shaped it to some extent. The first thing we do is to drill through the brass a hole a little less in diameter than the piston-rod, and form in this hole a screw-thread by means of a tap of suitable size. We then by means of files reduce the metal to the required shape, detaching the piece when we have proceeded as far as we can. The unfinished end of the detached piece can be operated upon if we fix the other in the hand vice. With the screw-plate we form on the end of the piston-rod a thread corresponding to that in the cross-head, and screw home the latter to its place, which should be a quarter of an inch from the extremity of the rod. In the projecting part of the rod a hole will have to be drilled for the reception of the pin, which will attach the connecting-rod to the piston-rod. This hole, like the cross-head, will have to be in the same plane as the bed-plate.

The fly-wheel and its axle, or crank shaft, come next in order. The wheel may be turned and cut out of a solid piece of brass by a great expenditure of energy and material, or it may be cast in type-metal, by first modelling it in wood, and from that making an impression or mould in moulder's loam. All things considered, however, we would advise our pupil to purchase this part of the engine ready-made. Having procured the wheel, we may proceed to make an axle for it. The axle will be three inches long, and may be made of iron wire a quarter of an inch in diameter. Its form and crank

attachment are shown in Fig. 77. It will be observed that one of its ends (A) is reduced in diameter: that is to fit it to the bearing in which it will work. Then there is an even portion, to which the fly-wheel, eccentric, and a small pulley for working the governor are fastened side by side a little distance apart; a portion is then reduced to fit the second bearing, and beyond that there is a plain piece, and then a screwed portion on which the crank is fixed. By keeping the crank at the end of the shaft in this way, we avoid the necessity for making a crank on the material of the axle—a rather troublesome job. Here we make the crank a separate piece, and screw it on to the end of the axle. The fly-wheel should be fitted tightly to the axle, and fixed by a key inserted in a notch, filed on one side of the aperture through which the axle passes.

In making the eccentric disc we must calculate its motion, so that it shall just move the slide-valve through the short distance it has to traverse, and no more. The rule to guide us is this:—First ascertain what is the exact space which the slide-valve traverses, and then make the distance from the centre of the crank-shaft to the farthest edge of the disc the same. We shall suppose that the slide-valve's journey is half an inch. Now, if we make the eccentric disc one inch diameter in the groove, we shall require to make the centre of the point at which it is attached to the crank axle a quarter of an inch aside from its true centre. This will cause a difference of half an inch in the extreme points of its revolutions, and give us the amount of reciprocating motion we require. The

Fig. 77.—AXLE OF ENGINE.

eccentric and the mode of attaching its rod are shown in Fig. 75. The disc has a hollow in its periphery to accommodate the strap of metal which is attached to the eccentric rod and clasps the disc. The disc is attached to the shaft in the same way as the fly-wheel. Close to the latter the governor pulley is fixed. It may be three-quarters of an inch in diameter, and made of brass one-eighth of an inch thick at the rim.

Bearings have now to be provided for the crank-shaft. These we shall make of brass. Each bearing is in two pieces—one a sort of crutch to support the shaft, and the other a cap-piece to screw down over this, in order to prevent the shaft from having an undue amount of play. The bearings have to be of such height as shall bring the central line of the axle on to the same plane as the central line of the piston-rod. The making of the bearings will afford a fine piece of filing practice. In the projections at either side holes have to be drilled, for inserting screws to fix the bearings to the bed-plate, and for the attachment of the caps holes have also to be bored and screws provided. The latter may be made from brass wire, turned down in the lathe and threaded with the die-stock. The portion on which the bearings are to be fixed must be determined by the most careful measurement. When the bearings have been fixed, the crank-shaft may be lifted on to them and the caps screwed down. In the covers of all bearings and in all rod-heads small holes should be bored to allow of the application of oil to the surfaces subjected to friction.

At this stage the cylinder may be put into its permanent position. For the purpose of attaching the cylinder to the bed-plate, projections are cast upon the ends of the former. If holes be not already drilled in these we must drill them, making, at the same time, corresponding holes in the bed-plate. Although the cylinder and steam-chest may be opened after they are fixed to the bed-plate, it would be well, before fixing them, to undo and examine all their parts and apply a little lubricating oil. The utmost care must be taken to set the cylinder in a position parallel to the edge of the bed-plate, and to screw it down so firmly that it shall not move on its bed when the engine is working.

Now we have virtually completed the most important parts of our engine; but they stand apart and distinct, and we must connect them in order that they may constitute one harmonious system. For this purpose we have to provide connecting-rods to link our piston-rod with the crank, and the slide-valve rod with its eccentric. We shall take the slide-valve connection first, as we can get at it more easily before the other is fixed. On referring to Fig. 75, it will be seen that the eccentric connecting-rod has a crutch-shaped end, which clasps the disc over half of its circumference, the remainder being covered by a supplementary piece flanged and screwed to the extremities of the crutch. The groove in the disc is one-eighth of an inch in width by half that in depth. The band of metal which clasps the disc is called a strap, and, as we have seen, is in two portions, connected by screws passing through their flanges. The strap may be most conveniently made of brass. The outer part may be cut from a sheet of that metal, and filed down to the required dimensions, the flanged ends being formed by bending the metal with the pliers. Owing to the second section of the strap requiring to have a thick part, or boss, on which to receive the end of the connecting-rod, it will have to be filed from a piece of square brass a quarter of an inch in diameter. Its form is so clearly indicated in the diagram that we need not enter into any detailed description. Making and fitting the eccentric straps is a nice piece of metal-work, and the pupil who can execute it satisfactorily need not despair of accomplishing anything that we shall set him to in the course of our farther lessons in engineering.

The rod which is to extend from the eccentric strap to the slide-valve rod may be made of iron wire one-eighth of an inch in diameter, softened by making it red-hot and allowing it to cool slowly. The end to be attached to the strap requires to have a screw-thread put on it, with a die corresponding in size to the hole already made in the boss of the strap. Its other end will have to be provided with a forked piece to clasp the end of the slide-valve rod. Had we chosen to forge the rod, we should have worked upon the end of it a block of metal that would admit of being reduced to the required shape by filing. The plan we adopt is simple, and more within the capabilities of the amateur mechanic. Here is a piece of brass half an inch long, one-quarter of an inch thick, and three inches and three-eighths wide, and we shall make of it a very serviceable fork without much trouble. Fixing it in the vice, we first bore into one of its ends a hole for the reception of the eccentric-rod. We then cut into the other end across its smaller diameter a rectangular notch of sufficient width to allow the rod of the slide-valve to move easily in it. Through each limb of the fork a hole has to be drilled, to receive the pin or bolt, which is to pass through the extremity of the rod in question. The fork may be reduced in bulk somewhat, and have its angles rounded. The length of the connecting-rod will have to be determined by exact measurement; but as it has a screwed connection at each end it may be readily adjusted in this respect.

Having adjusted and coupled up the eccentric-rod, we are free to proceed with the main connecting-rod, which is to link the piston-rod and the crank

together. This will require to be more substantial than the rod we have just completed—say three-sixteenths of an inch in diameter. It may be simply a piece of iron wire of that thickness, as we shall make its forked end and its attachment to the crank in the same way as we did those of the eccentric-rod. The fork we make of brass, of slightly larger dimensions, and provide for its being screwed to the end of the rod and for its attachment to the piston-rod exactly as we did in the other case. For the purpose of connecting the rod with the shaft we furnish it with a brass head. We need not here copy exactly the manner in which the connection is made in large engines, and make the head in sections to be put together with screws. Our purpose will be served admirably by an oblong flat piece of brass with a hole through it to receive the crank pin, and another to fix it to the end of the connecting-rod. The piston-rod we attach to the forked end of the connecting-rod by passing a pin through them, and the other end is attached to the extremity of the crank arm by a screw having a smooth body for the shaft-head to work upon.

We have yet, however, to provide slides for the cross-head of the piston-rod to run upon. These will have to be a little over two inches in length, corresponding with the length of the piston stroke. They will have to stand at a height corresponding with the line of motion of the piston-rod, and may be made of hard brass. Two small turned pillars will be required for the support of each. Their faces will have to be of a form corresponding to the groove in the cross-head. An end view of them and the cross-head is given in Fig. 76. When the slides are ready and the other parts adjusted we complete the connection, and so reach an important stage of advancement with our work.

The governor next claims attention. Its use and mode of action have already been described in a general way. A convenient position for it is the space between the cylinder and the fly-wheel, and nearly in a line with the latter. It consists of an upright spindle supporting two balls of metal suspended from a jointed frame. The spindle must be long enough to stand two inches above the bed-plate, and to extend downward through it to a socket in the mahogany base of the engine. Half an inch above the bed-plate, a horizontal pulley has to be fixed on the spindle, to receive a cord from the pulley on the crank-axle. On the top of the spindle a cap is fitted, on opposite sides of which the arms of the governor are hinged. These arms may be formed of slips of brass made by flattening a piece of wire with a hammer. About midway down, the arms are jointed to short bars, which connect them with a tube fitted easily on the spindle and capable of sliding up and down in response to the action of the balls, which the arms carry at their extremities. The sliding tube has hinged to its lower part a lever, which acts either directly or through intervening levers upon the throttle-valve, which is situated in the steam-pipe a short distance from its junction with the steam-chest. The form and proportions of the governor are so distinctly shown in the diagram that we need not enter more into detail. The governor is not essential to the working of an engine such as ours; but of course its presence makes the model more complete and interesting. It may be omitted should the pupil not care to undertake its construction.

When the governor has been completed we are ready for steam, and must now turn our attention to the boiler and its fittings. We may have either a horizontal or a vertical boiler. The latter is preferable for various reasons, and we shall adopt it. In order to generate a sufficient supply of steam for our engine, we shall require a boiler three inches and a half in diameter, and nine inches in height. Its form and internal arrangements are shown in Fig. 78. The "shell" of the boiler is composed of a cylinder of copper riveted up the side, and brazed to make it steam-tight. The conical bottom of the boiler and the funnel are joined together before being inserted and riveted; and the top, which has a flange round its edges, is

fitted with the safety-valve and tap for the steam-pipe before being fixed. The making of the boiler is a difficult task for an amateur, and he had better buy the article ready-made. The makers of boilers always carefully test their work before sending it out, and there is consequently less danger of their boilers giving way, than one made by an inexperienced hand working with imperfect appliances. A riveted copper boiler of the size we require, and fitted with lever, safety-valve, man-hole, stop-cock, gauge-tap, and spirit lamp, may be purchased for 25s. or 30s.

Supposing that we have either made or bought a boiler, our next step is to connect it with the steam-chest. For this purpose we use a piece of brass pipe a quarter of an inch in diameter, fitting and screwing its extremities to the boiler and steam-chest respectively. We also attach a piece of pipe to the discharge steam-port, to conduct the waste steam to any desired distance. Our engine is not fitted with a condenser, and so its steam is discharged into the air. In charging the boiler we use hot water, as that facilitates operations, the action of the lamp being rather slow. The quantity of water used should be slightly over half what the boiler will contain when completely filled. Our lamp may be charged with spirit of wine or naphtha, and the wicks should be of cotton, and so thick as to fill the tubes tightly, as otherwise the spirit will ascend too freely and cause trouble. While steam is being got up, we may oil the working parts of the engine. This we do with fine olive oil, applied with a piece of wire or the tip of a feather. The parts to be oiled are the bearings of the crank-axle, the rim of the eccentric, the crank-pin, the couplings of the piston and slide-valve rods, and the spindle of the governor and its attachments. It is presumed that when the cylinder and steam-chest were finally examined all parts of them subjected to friction received a coating of oil. The flow of steam from the safety-valve now indicates that all is ready for subjecting our handiwork to a crucial test. We open the throttle-valve, and turn the fly-wheel once or twice with the hand, and then we are delighted to observe that the engine is actually working. If the instructions given are carefully attended to, there can be no doubt about the result: the engine will run, and run smoothly, so long as it is supplied with steam.

Fig 78.—BOILER OF ENGINE.

HOW TO MAKE A MODEL LOCOMOTIVE ENGINE.

The locomotive engine has been described as the grandest achievement of the mechanical engineer, and no doubt it has many claims to be so considered. It is a perfect embodiment of strength, and all its parts are made of specially selected metals. Steel is now largely employed in locomotive building, because weight for weight it is very much stronger than iron; and lightness is an important consideration with makers of railway rolling-stock. Yet a first-class locomotive is far from being a light burden for the rails. With its tender it will weigh from fifty to sixty tons, and the cost of the pair is about £3,000. So carefully are locomotives made that it is reckoned that each will draw a train for one hundred thousand miles without requiring any but the most trivial repairs.

In constructing a full-sized locomotive there are no fewer than five thousand separate pieces of metal required, and in face of a fact like this the amateur

mechanician who thinks of making a model is apt to despair. He need not do so, however, for he can complete his task in a highly creditable way with a fraction of this number of pieces. Parts which in the large locomotive have to be built up by riveting he can fashion from the solid very easily; and if he will now take us for his guide we shall briefly advise him how to proceed.

There are three essential parts in a locomotive—first, the frame, with its wheels and springs; second, the cylinders, pistons, and connecting gear; and third, the boiler, with its fittings. The making of all these from metal in the rough would be a formidable undertaking; indeed the chances are that few young mechanicians would persevere to the end. All the castings and forgings necessary for model locomotives of various sizes may be purchased of or through any maker of scientific toys. Fig. 79 shows a locomotive of a pattern the parts of which may be so obtained. The castings and forgings for an engine of this kind, measuring

Fig. 79.—LOCOMOTIVE ENGINE.

fourteen inches in length and with driving wheels three inches and a half in diameter, will be about £4. This size will be found very suitable, as its parts are such as one may handle freely, and when completed the maker will possess a model of which he may well be proud.

Working drawings for guidance in the construction of the model may be obtained along with the castings, &c. These should be carefully studied, and each of the separate pieces of metal examined in relation to the place it is to occupy. We may start actual work by turning the wheels down to the required dimensions and drilling holes in the axles. The spokes should then be nicely filed. The axles may be taken next, and necks for the bearings formed, and also reduced parts on which to fix the wheels. A considerable amount of time and very careful work will have to be expended upon the cylinders and their attachments, the connecting-rods and the cross-head slides; and as we proceed one part must be tested by another. The bed-plate, with its various apertures and projections for attaching the boiler, wheels, and cylinders, will also afford a considerable amount of occupation. The boiler is usually supplied with its steam-dome, &c., fixed, and requires only a little adjustment. As the parts are thus prepared they are put aside until all are ready, and then the work of putting them together may be

proceeded with. With the instructions already given, and the working drawings and elevation of the engine before him, our pupil will not find much difficulty in turning out a satisfactory piece of workmanship, and we need not confuse him with any more detailed suggestions here.

HOW TO MAKE A MODEL STEAM-SHIP.

Probably our pupil may desire to make a model steam-ship. In any case, our instructions would not be complete unless we dealt with that subject. If he has studied what we have said with regard to the construction of model yachts, he will have no difficulty in fashioning the hull of a model steamer. He will, however, require to adopt different proportions from those set down for a cutter or a schooner. Some of the great screw steamers in the Atlantic trade have a length equal to ten times their width; but if we restrict our model to a length of seven, or even six, times the width we shall find it answer very well. Let us lay down the plan for a vessel thirty-two inches in length by five inches in extreme width. We give her a very fine bow and stern, but retain a portion amidships and abaft of that pretty full and but little rounded on the bottom. This part is to be the engine-room, and the reason of our leaving it full is to obtain a good floor on which to erect the boiler and engines. The vessel may be made of a fine, clean, even-grained piece of yellow pine, and the hollowing out should be so managed as to remove as much wood as possible without thinning any part of the sides too much. In this way the greatest amount of buoyancy will be obtained.

As the vessel will not have to carry any press of sail, and as the engines will serve as ballast, we shall not require a lead keel. A false keel, formed of a slip of wood three-eighths of an inch in depth, will, however, improve the appearance of the craft, and that we attach as soon as the shaping and hollowing of the hull are completed. In the thin part of the wood of the stern known as the "dead-wood" an opening has to be formed for the screw to work in, for we are to provide the vessel with a screw-propeller in preference to paddles. The easiest way to make this opening is to cut the dead-wood away to the extent required, and provide a stern-post to attach the rudder to. The stern-post is fixed at its lower end to a prolongation of the false keel, and at its upper end in a hole prepared for it in the ship's counter. Before the stern-post is put into its position careful measurements must be made, and the position of the hole or "tunnel" through which the screw shaft is to pass determined. This hole is then bored, and the bearing of the shaft fitted to it.

Before proceeding farther with the hull, we must prepare and fit our engines. Owing to the limited space available on shipboard, it is desirable to make the engines of steamers as compact as possible, and this requirement has been met to an extent that is truly wonderful. The oscillating cylinder is a great economiser of space, as it acts directly on the screw shaft without the intervention of a connecting-rod. In the earlier marine engines the beam was a prominent feature, and by the space it occupied greatly hampered the development of steam shipping. Now the oscillating engine is in universal use, with the most satisfactory results. Two cylinders are employed generally, and they are placed in different positions, according to circumstances. In some cases they are mounted overhead, in others horizontally on either side of the shaft, and a third and common arrangement is to place them in diagonal positions.

Here, as in the other cases, complete sets of castings may be obtained from the dealer in mechanical toys, or parts may be had finished. We advise our pupil to purchase the cylinders in a finished state. The size required will be one inch in diameter, with a stroke of one inch and a quarter. It would be well to purchase the crank-shaft ready turned. The engine frame may be readily made. In the first place we must prepare a foundation. This we make of a piece of mahogany, a little larger than is necessary, to accommodate the engine and boiler. The lower

side of this board we pare until it fits closely to the bottom of the vessel's hold. The brass bed-plate has next to be made, and two apertures for the crank to dip into cut out of it. A portion of wood beneath these apertures may also have to be pared away. On the middle bar of the bed-plate a bearing for the crank-shaft is fixed, and another on the bar which forms the stern end of the plate.

A second plate of similar size and shape has to be made in order to support the cylinders. This second plate is to be supported above the first at a height of one inch and a half, on brass pillars, turned and furnished with screwed extremities. The turning of the pillars and the shaping of the plates will afford us some excellent practice with the lathe and files. On the centre rib of the upper plate the "steam-block" is mounted. This is a solid piece of brass, with a number of holes bored in it for the passage of the steam to the cylinders. There is no steam-chest as in the stationary engine, the ports being opened and closed alternately by the oscillation of the cylinder over the aperture in the steam-block. On the outer side of each cylinder is a in the end of which forms a pivot for The steam pipe from of the steam-block, steam to escape by other.

The boiler is a cylindrical vessel of per, having a cavity lower part for the commodation of a lamp to supply the place of a furnace. It is also fitted with a steam dome and safety valve. The form and arrangement of the engine and boiler may be seen in Fig. 80.

Fig. 80.—MARINE SCREW ENGINE.

The screw-shaft must be of sufficient length to extend through the stern tube until it nearly touches the stern-post. The latter, by the way, should not be fixed until after the engines are in and the screw fastened in its position on the end of the shaft. The screw best suited for vessels like this is a two-bladed one (Fig. 81). It will be observed that the blades have a peculiar twist. The effect of this twist is to make the screw grip the water and draw itself, and consequently the vessel, forward, just as a screw-nail passes into the wood when it is turned round with a screw-driver. A screw one inch and three-quarters in diameter will be large enough for our boat, and it may be attached to the shaft either by keying it on or providing a nut on the end of the shaft to press the screw home against a shoulder formed on the shaft just outside the stern tube. In the stern tube bearings a packing of greased tow must be provided to exclude the water. When the screw is mounted the stern-post may be put into its place and the rudder attached.



Fig. 81.—SCREW FOR STEAMSHIP.

It will be well at this stage, after oiling all the bearings, to test the working of the engines. Before getting up steam, however, a careful examination of all the parts should be made, to see that they move freely, and that the connections with the hull are sufficient. Being satisfied on

these points, pour hot water into the boiler until it is half full, and then light the lamp and slip it into the furnace. In a little time the appearance of steam issuing from the safety-valve will advise us that our motive agent is ready. We open the throttle-valve and give a turn to the screw with the hand to start the engines. If all is right they will continue to work so long as steam is supplied. In order to test the trim of the vessel, she should be set afloat. It is more than probable that she will sit too deep by the stern, and we must introduce ballast in the shape of sheet lead into the fore-part of the hold. This should be adjusted so that the vessel will float in a perfectly upright position, and that her bow shall stand about an inch higher out of the water than her stern.

As there is still a good deal of work to do before the vessel is completed, we must place her in dock again. The first thing to be done is to fit the deck. This should be made in two or more parts, to admit of the portion over the engine being readily removed. The front part may be bedded with putty and nailed, but the section over the engine should be formed with a lid to lift off when necessary. But the best mode of doing this part of the work will occur to our pupil when he takes it in hand. Our steamer is to have two masts, and these we proceed to make next. What are known as "pole masts" are the kind with which steamers are most commonly supplied. These consist of one long spar, so that jointing is not necessary. They will require to be ten inches in height above the deck and three-eighths of an inch in diameter at the bottom, tapering very slightly for seven inches, at which point a notch is made, and the upper part of the spar considerably reduced and tapered away to a diameter of one-eighth of an inch. Half an inch from the top a second notch is made for the stays to rest upon. The rig, as will be seen, is very simple, and after the instructions given for rigging a cutter will be easily managed by our pupil. The hull may now receive a final rubbing down with glass paper, and be painted and varnished according to fancy.

HOW TO MAKE A MODEL PADDLE STEAMER.

Since the screw-propeller was brought to some degree of perfection, that mode of urging vessels through the water has superseded the paddle to a large extent. This is especially the case as regards ocean-going steamers, which have to face all weathers, and which, if fitted with paddles, would be exceedingly cumbersome in a sea-way, and difficult to handle in entering or leaving dock. It is its compactness that chiefly commends the screw, for it does not give any advantage over paddles driven with the same expenditure of steam, while the amount of vibration caused by the screw is much greater than that arising from the paddles. On lakes and rivers paddle steamers hold their own, and it is just possible that our pupil may prefer a paddle to a screw boat. In case he should, we shall give him a few hints as to how to proceed with its construction.

The hull need not differ from that we have described, nor need the size of the cylinders. There are, however, considerable differences in the arrangement of the cylinders, crank, and other parts. The boiler should be of the same size and similarly fitted to that proposed for the screw steamer, but whereas the latter was placed forward of the engines, in the paddle boat it must be placed to the rear of them. In a screw boat the cylinders are mounted above the shaft; in the paddle boat they must be placed beneath. For supporting the engine and boiler a platform is required, and in this an aperture has to be cut to allow the cylinders to descend to the extent of about one-third their height. Over the aperture a brass plate, similar to the bed-plate of the screw engine, has to be fitted. This plate, it will be remembered, has two holes cut in it, one for each of the cylinders. On the rib between these holes the steam block is fixed, and on the outer edge of each hole a stud has to be fitted, to support the pivot on which the cylinder oscillates.

At either extremity of the plate a brass standard, shaped like the letter A, has to be set up, to carry the bearings of the crank-shaft. The standards and the bearings must be nicely adjusted, so that their central line will fall exactly athwart the vessel. The crank and the paddles may be purchased separately. The former only an amateur of great experience could make, and it is better to buy it already forged and roughly turned. In finishing it the chief care will be to make the parts which will run in the side bearings and in the heads of the piston-rods as smooth as possible. The bearings, too, must be made with much exactness. If the paddles be obtained ready-made, as we advise, their fitting on to the ends of the shaft will be easily managed. Fig. 82 shows the completed engine for a paddle-boat.

The centre of the paddle-wheels should be in the centre of the length of the ship. Having ascertained that point, a notch must be cut down through the

Fig. 82.—ENGINE FOR PADDLE-BOAT.

bulwarks to allow the ends of the crank-shaft to drop to their position, which should be low enough to allow the paddles to enter the water to the depth of an inch. No bearing will be required on the ship's sides, but after the crank is put into its place it should be encircled by pieces of tin, or thin brass, nailed to the outside of the vessel and fitting closely so as to prevent water from passing into the engine-room. The paddle may now be fixed to the shaft, and that done the building of the paddle-boxes may be proceeded with. The sides of the latter may be most conveniently made of two pieces of thin wood, and the top of tin nailed to these. The boxes must be half an inch longer than the diameter of the paddles, and about the same extent wider. The tin used for its cover need not be very stout, and in cutting it a portion should be allowed at each end to turn out horizontally and be attached to the "sponsons," as the triangular boarding or deck which fills in each corner before and abaft the paddle-boxes is called. The sponsons may be made of cigar-box and supported on "knees," fashioned from stout brass wire, filed down, bent, and bolted to the sides of the vessel. In constructing the paddle-boxes our pupil will find his ingenuity

considerably taxed ; but no doubt perseverance will carry him through the work satisfactorily.

Before putting on the deck, it would be as well, as a precaution against the vessel foundering, to put in a watertight bulkhead, or partition, immediately in front of the engines and another immediately abaft of them. The bulkheads may be made of wood a quarter of an inch in thickness, and should be well bedded in putty. A couple of nails driven into them through the deck will keep the bulkheads in position. The large air-spaces thus provided will be sufficient to keep the steamer afloat, even should the engine-room by any chance become filled with water.

As regards rigging there is no reason why the paddle-boat should differ from the screw, and the instructions given for dealing with the latter may be applied here.

HOW TO MAKE A DRAW-PUMP.

The draw-pump must be a familiar object to most boys, but probably few concern themselves to know how it is that the working of the handle brings the water from a depth of many feet, and delivers it through a spout. There are important scientific principles involved in the construction of a pump of the commonest kind, and these we propose to explain, and also to instruct our pupil how to make pumps of various forms.



Fig. 83 -
SECTION
OF
SQUIRT.

The first thing to be explained is why water rises in a tube above its own level. If we dip a piece of straw, or other small tube, into a tumbler containing water and suck out the air, we shall find that the water rises to the mouth through the pipe. This occurs because when the pressure of the air is taken off the surface of the water within the tube, the pressure of the air upon the water outside the tube forces the fluid upward. In the syringe, or "squirt," we have a further illustration of the law by which water insinuates itself into a space from which the air has been drawn. The squirt consists of a tube in which a tight-fitting piston works. If the nozzle of the squirt be dipped into water and the piston be drawn upward, the tube will be filled with the fluid, because the piston has forced out the air which occupied the tube at the outset of the experiment. Here is a section of the squirt (Fig. 83), by means of which we shall illustrate the matter more fully. The piston is shown at the bottom of the tube, in which position it should always be before the nozzle is dipped into the fluid with which the instrument is to be charged. Between the lower side of the piston and the surface of the water there is only a small quantity of air contained in the aperture in the nozzle, and that is virtually of no account. Above the piston the tube is filled with air. If we now suppose that the nozzle is dipped into water and we draw up the piston, the air above the piston will be forced out at the top of the instrument, and the water will follow the piston into the space thus emptied. In order to discharge the water from the squirt we force the piston downward, when the water rushes out in a fine jet to a greater or less distance, according to the pressure applied.

It will be evident that though we can fill the squirt in the way indicated, we cannot empty it as a pump. We require provisions whereby, when the water has been raised to the upper end of the tube, it shall there be discharged, and whereby each stroke of the piston shall deliver at the higher level a quantity of water equal in bulk to the space through which the piston travels. To meet these requirements two valves have to be introduced, one on the piston and the other fixed at the bottom of the tube. In Fig. 84 a section of a pump is shown, in which the position of the valves is indicated. The upper end of a pump tube is wider than the lower part, and is called the "barrel," and in it the piston works and

the trap valve is situated. The piston and trap valves are identical in construction, and both open upwards. The latter (A) consists of a block of wood turned to fit tightly into the barrel, and having a hole in its centre equal to the diameter of the pipe (D) that descends into the well. Over this hole a stout but pliable piece of leather is placed and nailed to the wood at one side, so as to form a hinge. On the upper side of the leather a piece of lead slightly larger than the aperture is fixed, to act as a weight and make the valve shut readily. The piston (B) consists of a cylindrical piece of wood turned down to move easily in the barrel. A groove is formed round it for the reception of some tow or other stuffing to make it air-tight. The valve in the centre of the piston is, as already observed, similar in construction to the trap valve. The piston-rod is forked, to allow the valve to play freely. At the top of the barrel is a square chamber or box (C), into which the water flows as it rises in the barrel, and whence it is discharged through a spout (E). Mounted at one side of the box is the handle or lever (F) by which the piston is worked.

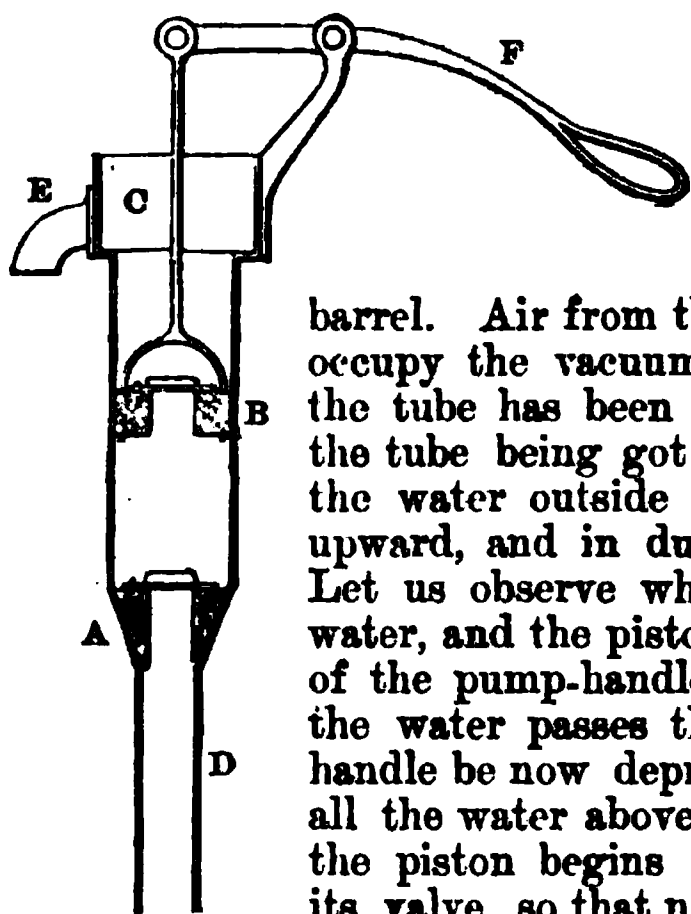


Fig. 84.—SECTION OF A PUMP.

When the handle is raised the piston descends, and on being brought back again carries with it the air which filled the barrel. Air from the pipe below passes through the trap valve to occupy the vacuum thus created, and so on until all the air in the tube has been drawn out. The atmospheric pressure inside the tube being got rid of in this way, the pressure of the air on the water outside the lower end of the tube forces the water upward, and in due time it appears in the barrel of the pump. Let us observe what now takes place. The barrel is full of water, and the piston is raised to the top. An upward movement of the pump-handle causes the piston to descend; as it does so the water passes through its valve and gets above it. If the handle be now depressed the piston will ascend and carry with it all the water above it, delivering it into the box. The moment the piston begins to ascend the pressure of the water closes its valve, so that none of the water is allowed to fall back. As soon, too, as the piston starts on its upward journey the trap valve is opened by the rush of water from below to fill the space behind the piston. In this way the barrel is charged for the next movement of the piston. When the latter begins to descend its valve opens under the pressure of the water, and simultaneously the trap valve is closed by the weight of the water above it. The whole operation is exceedingly simple, and when our pupil has comprehended it he may set about the construction of a model pump.

A convenient design for a model pump is shown in Fig. 85. For its construction we require a piece of brass pipe two inches and a half in length and one inch in diameter, and another piece three inches and a half in length and half an inch in diameter. The former is for the barrel of the pump (A), and the latter for the suction-well or pipe (B). Into one end of the former we fit a disc of hard wood a quarter of an inch in thickness. In the centre of this disc we bore a hole half an inch in diameter, for the reception of the upper end of the suction-pipe. The fit in this case, as in the other, requires to be rather tight, so that the union of the two pipes may be firm and the joining air-tight. The trap valve (C) should be made next. Its box may be turned out of a piece of sycamore a quarter of an inch thick. As already stated, the opening through it should correspond to the internal diameter of the suction-pipe. A piece of stout wash-leather will do

for the valve, and on the upper side of this a piece of sheet lead about the size of a sixpenny-piece, but thicker, should be fastened by a rivet passed through the centre. When the valve is completed we push it into the barrel, until it rests upon the top of the well-pipe.

We may now make and fit the piston. It is to have a stroke of an inch and a half. For its head we turn a disc of sycamore three-eighths of an inch in thickness. The edges of this disc must taper slightly from the centre, and at the latter point a groove for the packing has to be formed. The object of tapering the disc is to provide for the oscillation of the piston-rod in the curve described by the inner end of the pump-handle during each stroke. We might introduce a connecting-rod, as in the steam-engine, to negative this oscillation; but that is not necessary, as the degree of oscillation is not so large as to interfere with the effective working of the pump. The piston-rod is forked at its lower end, so that it may be either nailed to the edge of the disc or carried down through the rim of wood, and fixed by means of nuts on the extremities. The length of the rod from the lower side of the piston should be two inches. The upper end of the rod requires to be split to admit the end of the pump-handle, which is attached by means of a bolt. Brass will be the best material of which to make the rod, as it is easily filed.

Before proceeding farther with the mechanism of the pump we require to make and fix the box which is to receive the water as it is raised from the barrel. This is a square vessel fitted to the upper end of the barrel (G). By way of introducing a fresh material, we shall make the box of lead. We require to obtain a square piece, measuring three inches on

the side. The box is to be one inch and a half square and three-quarters of an inch in depth. Lead about the thickness of a florin will answer our purpose, and having obtained a piece of the size described, we measure off, and cut out of each corner a piece three-quarters of an inch square. Now taking a piece of wood of the dimensions of the interior of the box, we bend down the lead upon it as a guide, and hammer up the corners neatly. To give them strength, however, and to ensure their being water-tight, we shall require to solder the corners on the outside. To accomplish this we have to add to our stock of tools a small soldering bolt. This is simply a block of copper fixed at the end of an iron rod. Copper is used because it keeps the heat better than iron would. We also require some solder, which may be obtained from any plumber or tinman, and also a piece of rosin. To give the solder the best hold it is necessary to scrape the surface of the lead where the solder is to be applied so as to make it bright. Sprinkling a little of the powdered rosin in one of the angles of the box, we now take up the soldering bolt, which has been brought to nearly a red heat in the fire. We rub it on a coarse cloth to clean its edge, and then apply it to the solder. If the bolt is in proper condition it will melt and

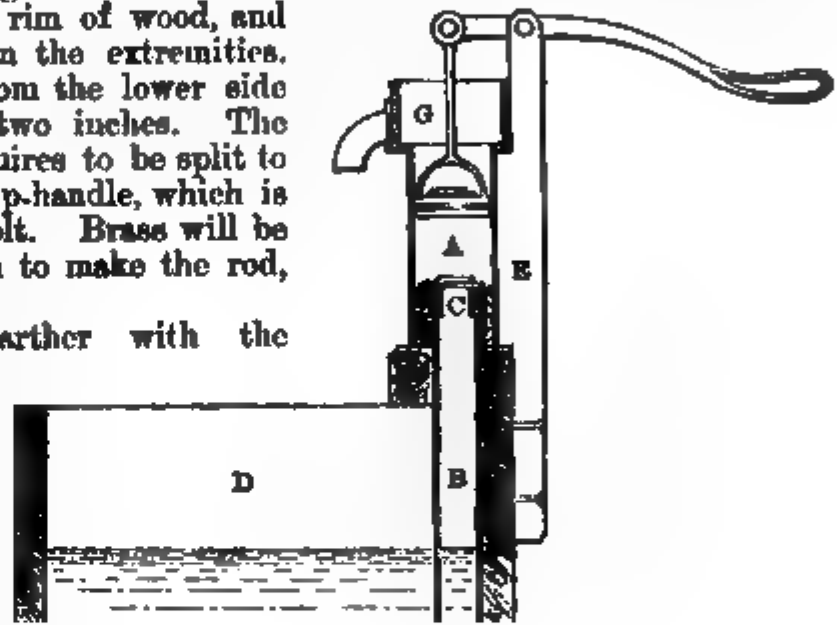


Fig. 85.—MODEL HAND PUMP.

detach a globule of solder which will adhere to it. Having got such a globule, we drop it upon the rosin in the angle of the box, and by rubbing the bolt over it gently cause it to spread evenly in the angle. The other corners are similarly treated. Should the soldering bolt not act properly, it will probably be because it has not been "tinned." To remedy this defect we must file the tip of the bolt after heating it, and then rub it in some rosin and solder placed upon a piece of sandstone. Unless the bolt can be got to take a coating of tin in this way it will fail to lift the solder or to spread it properly. One tinning of the bolt will serve for a number of heats.

A hole to admit the head of the barrel of the pump has next to be cut in the bottom of the box. This should be done neatly, so as to secure a good fit. When the hole is ready we take the barrel and file the upper part bright, to ensure that it is free from grease or other matter that would prevent the solder from adhering. The box is to be attached by soldering, and in order to effect a union between the lead and brass, we must first "tin" the part of the barrel that we have made bright. This is done by laying some rosin on the tube, and applying the solder until a thin coating of the latter is given to the brass. The box may now be placed upon the barrel and fixed by soldering round the bottom; a little solder may also be applied inside the box round the point of junction with the barrel. The box should be trimmed with a file, and its rim rounded off. In one side a hole three-eighths of an inch in diameter has to be cut, and a short piece of gas-pipe inserted to form a spout, as shown in the engraving.

A wood box five inches in length by three in width and depth will do for the tank. Across the top of this box (D) we nail a piece of deal, an inch and a quarter in width and half an inch thick, having first bored through its centre a hole that will admit of the passage of the suction-pipe. To support the pump, and also to provide a crutch for the handle to work in, we fix a slip of wood (E) to the back of the tank, carrying it up to a point about three-quarters of an inch above the rim of the box, and there forming in it a notch for the handle. A slip of brass passed round the barrel and attached to this stanchion will give firmness to the structure. The handle may be readily fashioned from a piece of stout brass wire flattened by hammering. We mount it in its crutch, insert and attach the piston, fill the tank with water, and then the pump is ready for action.

HOW TO MAKE A FIRE-ENGINE.

When it is desired that the water drawn from a well should be forced to a point considerably higher than the ground level a force-pump is employed. It might occur to an inexperienced mind that all that would be necessary in such a case would be to erect the draw-pump at the height to which it is desired to raise the water. A natural law operates against this arrangement. The pressure of the air will not sustain a column of water in a pipe more than thirty feet in height, so that a draw-pump becomes ineffective when that limit is passed. In the case of wells which have a greater depth than thirty feet, pumps of special construction are required, but with these we shall not concern ourselves here.

An excellent illustration of the force-pump is afforded by the fire-engine, a model of which may now be undertaken. As our engine is not necessarily a locomotive one, we shall dispense with a wheeled carriage, and construct the pumps over a water-trough, as we did in the case of the draw-pump. The trough may be a cube of nine inches, and across one of its diameters we fix a piece of deal an inch in width and half an inch thick. This is to support the air-vessel and pumps. The arrangement of the parts is shown in Fig. 86. The barrels of the pumps (A A) are to be made of brass tubing three inches and a half in length and three-quarters of an inch in diameter, and the suction-pipes (B B) of the same

material, but of less diameter, so that they shall fit into the barrels, and form with their upper ends a rest for the suction-valves (c c). The narrow pipes must be long enough to reach to the bottom of the trough, and in order that the water may

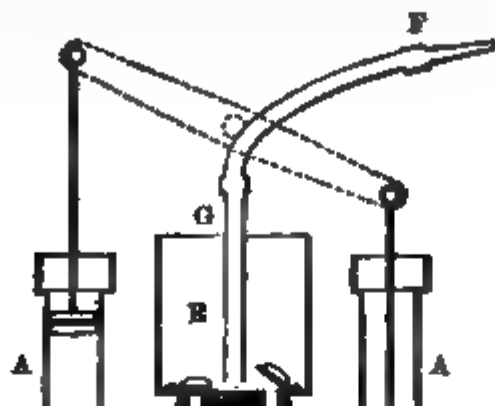


Fig. 81.—FIRE ENGINE.

have free access to them their lower parts require to be furnished with openings. To hold the pumps securely two transverse pieces of wood (D D) with suitable apertures for the pipes to pass through are inserted and nailed in position through the sides of the trough.

The air-vessel (B) occupies a central position, resting upon the cross-beam provided for it. Its use is to receive the water from the pumps and give it forth through the nozzle (F) in a steady stream. Were it not for this provision the pumps would send the water out in spurts. The upper part of the vessel is filled with air, which is compressed by the force of the water when the full force of the alternate strokes of the pumps is felt, but which expands when the force abates, and, as stated, sends out the water through the pipe (G) with a regular flow. Connection between the pumps and the air-vessel is established by means of two curved pipes (H H). In the bottom of the pump-barrels just beneath the junctions of these pipes, the trap valves are situated, and in

the end of each curved piece which enters the air-vessel is another valve which prevents the water returning after it has once entered the vessel.

Having made the trough of deal, about three-eighths of an inch thick, and ensured its being water-tight by coating the joined surfaces with white lead, we may proceed to construct the pumps and air-vessel. The material and dimensions of the pumps have been already mentioned. In joining the suction-pipe and barrel we shall require to use solder, unless we should happen to get the smaller pipe to fit into the larger so tightly that there shall be no leak; the trap valves may be made in the same way as that of the draw-pump. Their rims or boxes should be turned out of a piece of sycamore, care being taken to make them fit tightly into the bottom of the barrel. As we have a pipe of smaller diameter to deal with than in the draw-pump, the valve and its weight will be somewhat troublesome to make and mount. Before placing the trap valve into the tubes we must bore immediately above the position they will occupy a hole in each barrel to communicate with the curved pipe which leads to the air-vessel. This hole should be three-eighths of an inch in diameter.

For our air-chamber we shall require a piece of brass tubing two inches and a half in diameter and the same in length. This we must furnish with ends cut out of stout sheet brass and fitted exactly to the tube. In the piece that is to form the bottom we bore two holes at opposite sides, and about a quarter of an inch from the edge. These holes should be made of a size to admit one end of a half-inch screw coupling, such as is used in gas-fitting. In this portion of the coupling a valve of similar form to the trap valve, and, like it, opening upward, must be fixed. The couplings as obtained from the brazier may require some filing to adapt them to their purpose here. After they have been fitted and the valve inserted we must fasten them into the bottom by soldering. The bottom may then be soldered into its position. Now, taking the top piece, or lid, of the air-vessel, we bore in its centre a hole three-eighths of an inch in diameter, and into that fit and secure a piece of brass pipe of suitable diameter and three inches in length. This pipe should descend to within three-eighths of an inch of the bottom of the air-vessel, so that its upper end will project nearly an inch. The lid may now be soldered in. To ensure good joints in fixing the ends in the air-vessel, the ends should be pressed in almost one-sixteenth of an inch from the extremities of the tube. This will provide a rim, within which the solder may be run.

The connecting-pipes (H H) come next in order. They may be made of tin gas-pipe half an inch in diameter. We shall require a piece fully two inches in length for each. On one end of each piece we must solder the counterpart of the coupling inserted in the air-vessel, and trim the other end to fit closely to the side of the pump barrel over the hole already bored. The connecting-pipes may be bent either before or after the ends are trimmed; and that done, they are ready to be soldered to their respective barrels.

We may now attach the air-vessel to the pumps by means of the couplings; and that done, all is ready for the engine being placed in position over the trough. To this end the transverse pieces of wood (D D), which are to support the pumps, should be fitted and put into position, and the pumps dropped through their respective holes, and wedged therein if necessary. To steady the air-vessel and lessen the strain on the connecting-pipes a couple of straps of copper wire should be passed over the vessel and led under the beam on which it rests.

Our difficulties are now virtually at an end, for all that requires to be done is to furnish the pumps with solid pistons, and connect them with an oscillating frame. The pistons are simply lozenges of wood tapered toward the top and bottom, and having a groove in the centre for stuffing. For piston-rods we require two pieces of stout brass wire. On one end of each of them we fix a piston, and the other we flatten slightly, and make a hole through for the reception of a rod by which the piston will be raised and depressed. Two stanchions, one on either side of the air-vessel and close to it, have now to be fixed to the cross-beam on which the air-vessel rests. Provision for fixing them should be made in the shape of holes or mortices before the beam was put into its position. The stanchions should be of sycamore—four inches in height, and half an inch square. To the upper part of each a double lever or beam, made of a slip of brass, and corresponding in length to the distance between the central points of the pump barrels, must be pivoted. The respective ends of these levers are coupled by means of a rod extending from one to the other, so that they together make a quadrangular metallic frame. The rods which form two sides of the frame pass through the piston-rod heads. It will be obvious that if the frame is made to oscillate, it will raise and depress the pistons alternately. If we now fill the trough with water, and work the levers, we shall cause the water to rise through the pipe (G), and make its exit by the nozzle (F), which may be connected with the pipe by means of a piece of indiarubber tubing.

SIMPLE BOOKBINDING.

SOME knowledge of bookbinding in its simplest form is useful to young persons, and a little instruction in it may not inaptly conclude the Workshop section of this book. To bind books in cloth or leather as they are supplied by the bookseller would require a number of special appliances, and an amount of instruction which could not be communicated here. We shall therefore content ourselves with explaining some of the simpler modes of fixing together files of newspapers, exercise papers, music, &c., and making cases for holding drawings or prints.

For a newspaper file we require a piece of stout pasteboard a little larger than the paper to be filed. If the length of the paper be fifteen inches the board should be fifteen inches and a half. Three inches from each end of the board and half an inch from one of its edges we bore holes with a bradawl. We next prepare a slip of wood three-quarters of an inch broad, a quarter of an inch thick, and of the same length as the board. In this we bore two holes corresponding with those in the board. A lace is our next requirement. One of cotton cord, a yard in length, and having a tin "tag" on each end, will best suit our purpose. Having passed one end of the lace through either hole in the board, we are ready to deal with the papers. Taking one at a time we pierce a couple of holes through its back margin half an inch from the outside, and the same distance apart as those in the board. Through these holes we pass upward the ends of the lace, and press the paper down firmly. When all the papers to be filed at the time have been put on in the same way, we take the lath already prepared, pass the lace through its holes, and then, tying the ends of the lace over it, make all secure. This is an excellent plan for keeping together single sheet manuscripts, and the like, as well as newspapers.

In dealing with music it is necessary to unite the pieces so that they may be spread out flat upon the piano. To admit of this we must adopt a more advanced mode of binding than that just described. Having mended all the torn parts by pasting pieces of paper over them, we take the pieces singly and attach them by sewing to them pieces of stout tape half an inch in width, and arranged at equal distances along the back of the pieces. When the sewing is completed we paste down the ends of the tapes, which should be at least an inch in length, upon a fly sheet provided at the beginning and end of the "volume." After the paste has dried we give the back a thick coating of glue. Two pieces of cardboard are then pasted down upon the fly-leaves to form corners, and the work is put away under a weighted board to dry. A strip of dark-coloured linen lining is next pasted upon the back of the book, so as to overlap the sides to the extent of an inch. The edge of this cloth and all the remainder of the boards may now be covered with marbled paper, and our task is completed.

To make a portfolio for drawings we require two pieces of pasteboard of suitable size, and a piece of bookbinders' embossed cloth, an inch or two larger than the two boards, laid side by side. Spreading the cloth upon a table we cover the whole of its inner surface with paste, and lay upon it the two boards, taking care to arrange them squarely, and to leave an inch of space between them. We then fold in over these edges the superfluous cloth, and paste it closely down. A stout slip of paper, to form the back of the portfolio, may be pasted on the space between the boards. When this part of the work has dried, a sheet of strong glazed paper should be pasted over the entire inside of the portfolio. Some pieces of tape inserted in the front edge of the boards will be serviceable for pasting the portfolio and keeping its contents secure.

HOME PETS.

BY LEWIS WRIGHT, AUTHOR OF "THE ILLUSTRATED BOOK OF POULTRY."

POULTRY.

By a thoroughly sound and healthy instinct, every family where there are children is sure to contain some boys who will take a great interest in any live animal. Even as pets they are valued, and do good; but if any useful purpose can be answered as well, so much the better. That is the reason why we begin the present division of this book with fowls. In many homes anything like a regular supply of really new-laid eggs is beyond almost any money value. Those who never have actually tasted an egg that indubitably *was* "laid this very morning," have absolutely no idea of the distance between it and what they have understood by "an egg." Such eggs are as rare and precious in large cities as a really well-cooked mealy potato is—anywhere. They can be eaten and enjoyed when nothing else can; and there is very solid profit to be got, as well as amusement, from keeping a few fowls.

And these eggs need *not* cost sixpence a-piece. Many people say they do; and there are eggs which have done so. But when this is the case there must have been mismanagement somewhere. They need not cost much in food nor much in trouble, and the fowls need not be a source of annoyance. The proper management of fowls is thoroughly understood now, and things will go pretty straight if the following plain and simple directions are attended to.

HOW TO BEGIN.

It is rather important to begin at the right time, and that should be the spring. If poultry-keeping is begun in the autumn, when all experience has to be got during the worst season, the first result is likely to be a whole host of discouragements. No fowls lay as well in the autumn and winter; and ill-selected ones may not lay at all, which is disheartening. But if it is spring when the first fowls are purchased, it must be very bad management indeed that does not result in *some* eggs during the next six months; and we have had curious experimental knowledge (from ten years old and upwards) of the remarkable extent to which even a small portion of the new, genuine, precious hen-fruit will buoy up hopes and expectations which might be considered generally rather gloomy. There will be some mistakes at first, probably, and perhaps some mishaps; but there will certainly be some eggs, which will keep up the spirits of the proprietor until he has learnt how to manage and plan. Decidedly begin in spring.

The next thing is to consider how many fowls are to be kept; and that will of course depend upon what space can be given up to them. Here we must avoid splitting upon a rock on which more people *have* split than on any other, except mistakes in feeding—the mistake of over-crowding. A very few fowls can be kept with ease, cleanliness, and profit, where double the number will give many times the trouble, besides the almost certainty of disease and loss. And it is not only this overcrowding; but in every family there are odd scraps of food which will more than half keep a few fowls in food, though not enough for more.

This alone will make twelve fowls cost almost as much again for each one in food as five or six will cost. Supposing there is an average city garden of twenty to thirty feet wide, and that six feet wide all across at the bottom of the garden can be given up to the fowls. With less than this fowls ought not to be kept at all; this space of six feet by twenty or thirty will be enough *with care* for four or five good-sized ones, *but not for more*. Some people would say it is too little for any; but they can be kept in such a place with profit, if well attended to; only where the five would thrive and pay, ten would do neither. If more space can be given, one or two more can be added, but it will be best

not to keep more than six to ten full-grown hens in any confined yard. People who have plenty of space, and especially if there is any grass for their pets to run upon, of course can be more ambitious.

Suppose the space is small, however, as described; still, let the house and all the rest, however roughly put up, be *good of the sort*. It must be tight and close, so as to be quite free from draughts, except through the hole by which the fowls enter; and should be ventilated by holes almost at the top, under the roof. The best and neatest



Fig. 1.—FOWL-HOUSE—PLAN AND FRONT ELEVATION.

way is to run the fence of wire or tanned netting all along the front of the strip, and to let the house occupy four or five feet wide at one end. Less than four feet is difficult to do anything in. The front of the house will then range with the front of the fence like this (Fig. 1).

With such a small space as this, the whole ought to be roofed as shown in the drawing. This can be done with either tiles, boards, or felt; but either of the two last will want tarring every two years at least. Another capital roof is to use boards first, tar rather thickly, rub down thick brown paper on the tar, and tar the paper again. To prevent any draught between the boards, the very best plan is to use what is called "match" boarding, tongued on one edge and grooved on the other to fit, and smoothed on one side. This really costs little more than plain boards, and makes a house both tidy and quite tight: but plain boards will do, only when they have dried a little the cracks between them should be caulked with string. The match-boards do not need this, and look so much neater it is better to use them. Nothing is needed besides a hammer and saw, tools which every boy should be able to use; and as the boards are made in twelve-foot lengths, they will cut both six and four feet without waste.

If there is a wall at the back and sides, all the better. In that case, dig a hole a foot deep for the corner-post of the house, in which plant a piece of "quartering" (timber 3 by 2 inches) high enough to stand six feet above ground. It is not absolutely necessary to make the house and shed high enough to walk under without stooping, but it saves much trouble. With iron stay-nails or hold-fasts, fasten another piece to each wall, level with the corner-post. Make half-joints with the saw at top of each post, and fasten thus horizontal pieces six feet from the ground. A door-post added to the front completes the skeleton of the

house, and it is only necessary to add the rafters for the roof, and nail on the boards.

It is well worth while to take a little pains over the floor of the house. Supposing it is earth to begin with, some stones or broken pieces of brick and pottery should be trodden in till they lie firm. Over this lay some rough concrete made with lime and sand, with some smaller stones or coarse gravel, and finally smooth with lime and sand alone. All this can be done with a shovel and trowel, and dries into a hard smooth floor which can be kept clean with the greatest ease. It is best laid so as to be a few inches above the ground level. As to the floor of the shed, if all stones of any size are taken away, it will do as it is for a while: we shall see more about it by and by.

As to the inside of the house, after trying many plans, we think there is none better than that of a broad shelf under the perch, as in the annexed diagram (Fig. 2). Here is shown a broad shelf at *a*, eighteen inches from the floor; at *b* the perch, five or six inches above; while the nests can go under at *c*. These nests will need no top; in fact a few bricks placed on their edges, so as to confine the straw, will answer every purpose, and the shelf keeps them quite clean. This shelf is to be scraped clean and slightly sanded every morning, and the floor itself is never polluted at all by the roosting fowls. The shelf also keeps off nearly all draught from the hole by which the fowls enter. This plan is not, however, necessary, and any other arrangement may be adopted that will keep the nests clean.

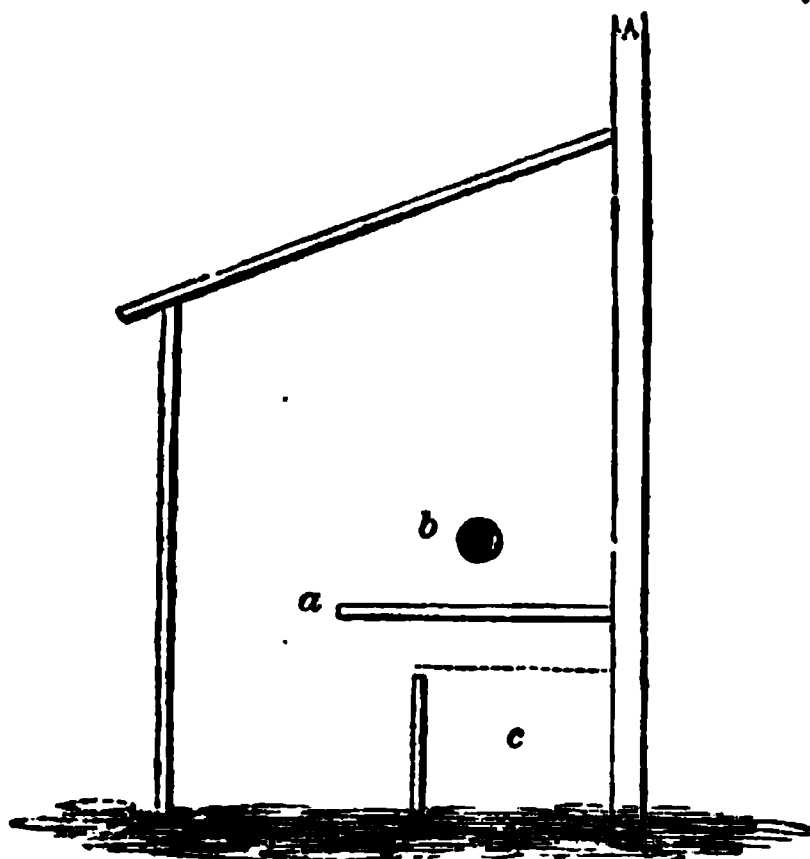


Fig. 2.—DIAGRAM OF THE INTERIOR OF FOWL-HOUSE.

Whitewash the fowl-house inside, and remember to repeat this operation about twice a year. Put a little shelf in one corner, and on it keep a dredger filled with carbolic powder, or a bottle of diluted carbolic acid, with a few notches cut with a sharp knife *along* the cork. As you swing such a bottle round it will sprinkle roof and walls and floor as well as the dredger; and if you use either in this way once or twice a week, and clean the shelf or floor every morning with a scraper, there will be little or no trouble from fleas or other insects. A good deal as to this depends on *beginning* right. As to the rest of the house, there is nothing more but a few nest-eggs—china are the best—and a little straw, to be changed for clean, the nests cleaned, and the old straw burnt or carried to a manure-heap away from the place every few weeks.

Now as to the larger shed outside, it must have a little sun some part of the day if possible, yet always affording shelter from that sun if desired. But the chief thing to remember about it is this: that fowls keep healthy and happy on clean dry ground, and need, to clean themselves, constant access to *clean* and *dry* dust, or earth, or ashes, in which they roll and dust themselves—their only way of washing themselves. On the contrary, they rapidly become diseased on damp ground, or ground foul with their own droppings; and soon swarm with vermin if their “dust-bath” is long dirty or damp. The roof of the shed ought, therefore, to project well in front, and have a gutter-shoot to carry off the rain

and keep it from splashing in. If this is attended to and it is dry soil, the shed may at first be dug over loose and sifted fine. Then a rake can be got, with thin steel teeth set very close—say three-eighths of an inch apart; and if this is drawn through the fine dry earth, say twice a week, it will remove all offensive matter, including cabbage leaves and stalks and other refuse, which must be removed as well as the droppings. If this plan is not adopted, you must dig up the earth every two or three weeks to bring fresh to the surface; and about four times a year carry it all out of the shed, bringing in instead clean earth from the garden. This will do the garden great good also. Even on the first plan this ought to be done at least twice a year. It does not so much matter which plan is adopted, so long as the shed is kept clean and pure, and seen to regularly at reasonable intervals.

But perhaps the soil is damp, and if so, other measures must be tried. It will not cost much to lay a floor like that already described for the fowl-house, a few inches above the ground level, and rather sloping to the front. Then on this you can place five or six inches deep of earth, or sifted coal-ashes from the house, or sand, keeping it clean with the rake. A board six inches high along the bottom of the whole front will keep this in, and prevent a great deal of rain

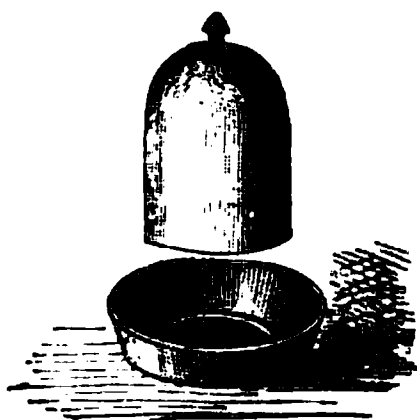


Fig. 3.—DRINKING FOUNTAIN FOR FOWLS.

flowing in, and generally keep the place dry; but if even this fails, in the most sheltered corner of all you *must* have a place kept to itself by boards set up on their edges, and filled with dry ashes sifted fine for the dust-bath. This fine, dry, clean dust-bath you *must* have, and must keep well renewed, to thrive with fowls. It is a very good plan to keep part of the shed hard trodden ground, which can be scraped pretty clean, to feed on and carry the water vessel; otherwise the latter is apt to have too much dust scratched into it. A piece round the entrance hole of the fowl-house is easily fenced off from the loose stuff for this purpose by a number of bricks laid on their edges.

Not much else is wanted. There will be a fountain for the water, of which one made in two parts like this (Fig. 3) is the best shape, but the common well-known shape will do very well. In fact any pan will do, provided the water is cool and fresh every day, and so protected that the birds cannot foul it. And in such confined space as is here supposed, some sort of a shallow dish or pan is better for the soft portion of the food. That is about all, besides receptacles somewhere or other for the corn and meal. A lad at all handy with his tools would put up all in a day, or at most two days, and lay the floor before breakfast next morning. And when all is right and *dry*—not before—the place is ready for the fowls.

Sometimes more space can be spared than we have described. If so, for a few fowls it will still be hardly possible to make a better arrangement, except that the shed should not be fenced in at the front, but open, the fence being brought forward, all across the garden, as far as is allowed, to form a yard. Some shed or shelter is necessary in any case; but the more room for exercise the fowls can have the better. We have also seen houses made to stand detached, on four corner-posts, the floor itself being two feet from the ground. The space under the floor, like that under a table, then forms the shed or shelter, and can be sheltered by boards on the two most exposed sides. This plan may be made to do pretty well, especially on hard ground; but care must be taken over the clean dry dust-bath, which may be, say, two feet square, and made like a square wooden tray for removal. Houses like this have the advantage of being movable, and any ingenious lad will easily make the side open so as to

take eggs from the outside; but particular care must be taken to keep the wooden floor and all within them very clean.

BREEDS OF POULTRY.

There are a great many breeds of fowls, which differ widely both in their outward appearance and in their qualities. Of their appearance the engravings will give a very fair idea, and it is always best to keep fowls which are liked, as more interest is naturally then taken in them; but some care must be taken that the fowls also suit the circumstances. One sort will thrive where another would not, and this has to be taken into consideration.

Common or barn-door fowls, when really good, are as profitable as almost any. They should be fine and well-reared, and young. The beginner will be little of a judge as to the age; but most people can find some friend who does know about these things, or from whom birds can be obtained which can be depended on. Beginning in spring, they ought to have been hatched the spring before. A good-sized,

Fig. 4.—WHITE COCHINS.

healthy-looking young bird of the well-known "cuckoo" colour will generally be a profitable hen, the colour showing a cross with some black breed, probably the Spanish. Stunted-looking chickens will seldom do much good even if they are young. But the best guide of all, if it is possible to act upon it, is to get the young fowls from a man who *always seems to have eggs in winter*. If you can get some of his stock, you will probably get the same. The only objection to common fowls is where there is no room beyond the house and shed above described. No chickens can be reared in a place so small as that, or at least to do any good; and as every hen will probably get "broody" once, at least, in the season, this will cause

Fig. 5.—DARK BRAHMAS.

trouble, which it is as well to avoid by choosing some breed which does not sit at all.

Of these there are many; indeed, the pure breeds may be very well sorted out into sitters and non-sitters. The first are suitable where a brood of chickens can be reared by each hen apart from the shed or yard where the fowls are kept, or in any place where there is plenty of room. The sitting propensity is most developed of all in the *Cochins* (Fig. 4). These are the fowls which produced such a "mania" when they were first brought into England, owing to their giant size and quiet, tame habits. They easily become as tame as cats, if kindly and familiarly treated. Besides their great size, the cocks weighing 10 to 13 lbs.

each, they are noticeable for their round, lumpy shape, short wings and tails, and feathered legs. The plumage is also very soft and fluffy, and a wire fence two feet high will generally keep them in. They are bred buff or canary colour, white, black, and partridge colour. The last is well enough adapted for the

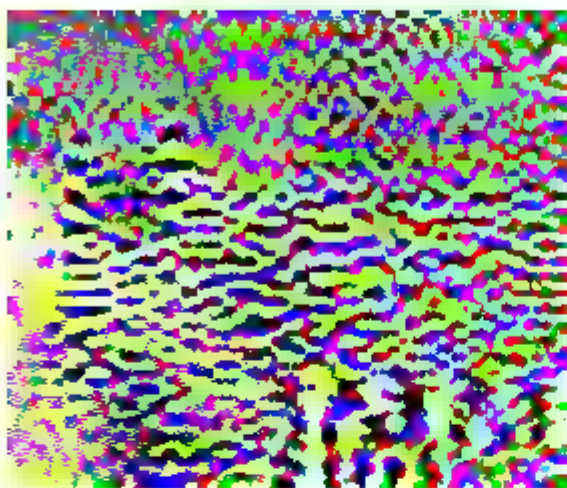


Fig. 6.—DORKINGS.

They are even hardier than Cochins, and bear confinement as well, while they do not sit so often, and are often splendid layers. Hens have been known to lay nearly all the year, in fact; still, as a rule, they sit pretty often, and the same objection, therefore, applies to them. The flesh is much superior to that of the Cochins. The eggs are usually brown or chocolate, but some are nearly white. They are bred in two sorts, called dark and light. In darks the hens are beautifully pencilled all over with pretty black marks on a grey ground, the cocks nearly or quite black-breasted, with striped hackles. The lights are nearly white, except the neck and the cock's hackles, which are striped, and the tails, which are black. These black marks make them prettier than white Cochins, and, owing to the harder feather, they keep cleaner. Brahmas have a funny comb, called a pea-comb, like three very little combs side by side in one, the highest in the middle.

Dorkings (Fig. 6) are fine splendid fowls, the very best of table poultry. They are bred dark-coloured, a silvery grey, cuckoo, and white. All the colours have a double claw behind, or five toes, as it is called. The whites have rose-combs; the coloured generally single combs, but sometimes rose-combs; the others almost always single. The Dorking does not sit very often—generally once in a season—but it never thrives well in close confinement, and does not stand damp well. It should therefore only be kept on dry soil, and where there is pretty free range.

Game Fowls (Fig. 7) are very handsome. Almost everybody knows that the cocks used to be fought for what was called "sport," but the barbarous practice has now ceased in all but a few low neighbourhoods. The fowl is now chiefly

smoke of a town, and the Cochins are hardy and bear confinement exceedingly well; but the hens are apt to get broody after laying from ten to twenty eggs, and this makes it an unsuitable breed where no chickens can be reared. The pullets are good winter layers if hatched early, but the meat is rather coarse. The eggs are brown or chocolate-coloured, and very rich.

Something like the Cochins are the *Brahmas* (Fig. 5)—quite as large, and also possessing feathered legs, but not so lumpy in make or so soft in feather. In fact, the Brahmas are very active birds indeed, but a three-foot fence will confine them, owing to their great weight.

Fig. 7.—GAME FOWLS.

bred for its beauty, to be exhibited at shows. It is not quite so fierce as it used to be, but still its pugnacity makes it almost impossible to keep this breed in confinement, and it never thrives well except where the birds can roam. Then it sometimes lays well, and the meat is the best of all. But our readers should not keep Game fowls. The *Malay* is a very tall Indian fowl, something like the Game, and even more spiteful, though not really so courageous. This, too, cannot be called a profitable breed.

Scotch Greys are a plain, useful breed, becoming more and more fashionable in Scotland. They are good-sized cuckoo-coloured or blue-speckled fowls, a little like Dorkings in shape, but more sprightly and lighter built, and without the fifth claw. They are capital eating, hardy, and good layers, and only want to sit about once a year. The Scotch also have some very comical little fowls, with legs so short the feet seem almost as if stuck on. These are called *Dumplings*, and are beautiful sitters, but only middling for eggs. It is curious that the French have a breed very much like them, but black, called *Courtes Pattes*. Most of the French fowls do not sit at all, and the people say these *Courtes Pattes* were bred to hatch the eggs of the others.

Fig. 8.—WHITE-FACED SPANISH.

Next we come to the non-sitting breeds. One of the oldest, and one of the best, is the great family of *Spanish*, which has many descendants. At the top in rank stands the white-faced Spanish, or *Spanish* proper (Fig. 8), distinguished by

the glossy black plumage, large red combs, slate-coloured legs, and "white face," resembling a fine white kid glove. This fowl lays very large white eggs, and plenty of them, and bears confinement very well; but to get the coveted white face it has been "bred in-and-in" a good deal, and has become in consequence rather delicate in constitution, the chickens particularly being very slow at fledging, and the old fowls suffering much in moulting sometimes. Owing to this a less highly-bred fowl, called the *Minorca*, is generally more profitable, and is one of the best fowls known for producing plenty of eggs. It is like the Spanish, except that it has not the white face, but only white

Fig. 9.—WHITE LEGHORNS.

ears; and it is called "black Spanish" by many people. Just like the *Minorca*, except that it is a slate-colour, with darker or black markings, is the *Andalusian* fowl, just as good as the *Minorca*, and with the same qualities. All this family lay large white eggs. From America has been imported a sub-variety of the same family, said to have been taken there from Italy, and called *Leghorns* (Fig. 9). It will be noticed that all the names come from round the Mediterranean. They differ from the others in being smaller, and having yellow legs instead of dark ones. These yellow legs are thought to show a cross with Game or some Asiatic fowl, and hence the *Leghorns* are hardier than any other branch of the family; while as layers they are, perhaps, the very best fowls known when a good family can be procured; but owing to

the birds being smaller, the eggs are smaller also. Leghorns are very hardy, and generally bear confinement pretty well; but the whole family, if allowed to be idle in a small place, is rather apt to take to the vice of eating one another's feathers—a habit which, once begun, it is very difficult to cure.

Leghorns are bred white, and what is called brown, the hens being something like partridges, and the cocks black-breasted, with red backs.

A very handsome race of fowls are the *Hamburghs*. They are rather small, very neat and sprightly in shape, and the cocks with very long flowing tails. The legs are always dark, and they all have rose-combs and white ears; but the great beauty is in the colour and marking. They are bred black, gold and silver *spangled*, and gold and silver *pencilled*; the blacks being the largest (owing, it is thought, to a cross with the Spanish fowl),

Fig. 10.—FEATHERS OF HAMBURGH. SPANGLED (A),
PENCILLED (B).

and the pencilled kinds the smallest. The Black *Hamburghs* have a peculiar intense green metallic lustre all over them. As to the others, the spangled birds are spotted with large black spots, one of which is on the end of each feather (Fig. 10, A); while the pencilled birds have each feather beautifully striped with several bars across (Fig. 10, B). The pattern a little varies in different parts of the body, but the engravings will give a good idea of the average kind of feather. The blacks and the silver-spangles (Fig. 11) are fairly hardy, but the others are generally very subject to colds or roup. They are excellent layers generally, if they can have free range, except gold-spangles, which seldom lay at all well, and blacks, which vary a great deal, some being very poor, while others are excellent. None of them, however, have ever done well in confinement except silver-spangles, and none of them often thrive penned up. They can fly almost like birds.

Fig. 11.—SILVER-SPANGLED HAMBURGH.

The *Polish* fowls are remarkable for their large top-knots or crests, and the beautiful marking too. They are bred all black with white crests, and silver (Fig. 12) and golden *spangled*. The spangled marking, however, is different from the spots in *Hamburghs*, being in *Polish* a line round the feathers, which gets thicker at the tips, except the tails of the cocks, which have a black spot at

the end. The Polish used to be splendid layers, and some are so still; but they have been much in-bred, and some have rather lost this. They are delicate in all damp situations, as if the crest once gets wet it takes a long while to dry, and naturally gives the fowls cold or roup; but if kept thoroughly dry under foot as well as over, they thrive very well—better than most—in even close confinement, and will become very tame.

The French have several very good non-sitting races, all evidently allied to the Polish, since more or less crest is seen on all the well-marked breeds. The *Crève-cœur* (Fig. 13) is a large black fowl, with a good-sized crest, also black. The legs are dark, and the body is very large and heavy. The comb is very curious, consisting of two branching horns. This fowl grows very fast, and is beautiful eating, and it lays very large white eggs, but not over many of them. It bears confinement well, however, being almost as quiet as the Cochin. *Houdans* (Fig. 14) are much more alert and lively birds. Lighter built altogether, they can fly very well, but are very good size on the table, though not so heavy as the *Crève*.

Fig. 12.—SPANGLÉD POLISH.

Their flesh is beautifully delicate. They, too, have a large crest, five toes like Dorkings, and the most singular comb of any fowl; it has been compared to two open leaves of a book, with a strawberry lying in the middle. The plumage is black and white mottled, not any regular pattern, but a sort of higgledy-piggledy, just as it happens. They are capital layers, if the right sort can be got, and very hardy. The *La Flèche* is a tall black fowl, which lays large white eggs, and is reckoned by the French their best table fowl; but it lays poorly and is very delicate in Great Britain. Some other so-called French breeds appear to be only fine mongrels, like the Surrey barn-yard fowls.

The many sorts of *Bantams* make nice pets, and often get very tame. They also bear confinement very well, but cannot be called profitable, their eggs are so small, and there are generally so few of them. There are *Black Bantams*, shaped like little black Hamburgs; *Game Bantams*, like little Game fowls,

Fig. 13.—CRÈVE-CŒUR.

and almost as pugnacious; comical short-legged, long-tailed *Japanese Bantams*, of various colours; some very rare ones, like little buff *Cochins*; *White Bantams*, with both smooth and feathered legs (there are feather-legged Blacks, too) and the exquisite little *Sabright Bantams* (Fig. 15). These are beauties, every feather being laced round with a black line, the ground colour either buff or clear white. The cocks have square tails, without sickles, like the hens. These beautiful birds, are, however, delicate, and very few of their eggs ever hatch, so

that those who keep them must make up their minds for many disappointments.

We have said that it is important to get some of these fowls "of the right sort," because even of the sorts that are the best layers there are good and bad. Fowls differ in the eggs they lay, some laying a lot, while others lay few or none at all. Of course one cannot always be sure of getting them from a good laying family; but people should try, by asking questions, to do so. Since poultry shows have multiplied so greatly in Britain, pure-bred fowls can be bought much cheaper than formerly. Of course, fowls almost perfect in every point, good enough to win prizes, would cost often many pounds; but many chickens which are not perfect in these things can be bought for very moderate prices if only wanted for laying, and many advertisements of such appear in the daily or weekly newspapers. On the whole, for eggs and profit, in a small space, the best fowls will be fine common ones, one of the Spanish or Leghorn family,

Fig. 14.—HONDANS.

Hondans, or if very dry, one of the Polish sorts. With more room there is much larger choice; but we have said enough about the main qualities of the different breeds to enable it to be made.

FEEDING.

When the fowls are purchased they will of course want something to eat; and this brings us to feeding at once. Now remember this one thing above all others—that to make them really pay, some one or other must regularly and perseveringly take a little thought and pains for them. They will not pay in any other way, and it is because people so often get tired of them, and leave them just to get along as they can, that so few fowls do pay. It is not enough just to feed them: they must be fed *right*. Something may be got from the house, though in many books too much is made of "scraps of bread" which are supposed to be "thrown to the fowls." For any household to have many such scraps would be a disgrace; and as to things which go to table, there ought to be little beyond the leavings of the vegetable dishes and a few scrapings from the joints. These, however, should be thrown daily, *however little*, into the bowl, minced up if necessary; not so much for any saving thus effected, but because in this way the fowls will get just the little animal food, well cooked, which alone can do them any good. Another item, however, is of more substantial value, viz., the potato peelings, and trimmings or peelings of other vegetables. These ought to be roughly chopped up and *well* boiled every day, till

Fig. 15.—SEEBRIGHT BANTAMS.

really soft and capable of being mashed easily with an iron spoon. To mix with this keep what is called in some places "sharps," in others "middlings," in a few places "thirds," in some "coarse country flour," and in one or two "pollard," though pollard properly means a very coarse kind of bran. The stuff we mean is very fine, and pinky, much finer than bran, and with some flour in it. When the potato peelings and vegetable scraps are boiled, pour off the water, which is injurious, and mix in the scraps of meat and fat chopped fine, with as much of the sharps as is needed to make up the required quantity. If the sharps is much and the other things little, some more hot water may be needed; but generally the moisture of the stuff itself will be sufficient. As a rule the sharps will be probably about equal in bulk to the other: it should be mixed so as not to be sloppy in the least. Mix and mash all well together with a large iron spoon, season *very slightly* with salt—only a few pinches—and feed it warm to the fowls in an earthenware dish of some kind, broad at the bottom so that it cannot be upset. On very cold or wet mornings a very slight sprinkling of pepper—either common or Cayenne—besides the salt will do good, but ought not to be given regularly.

This kind of food is not only the cheapest, but the very best the fowls can have for breakfast, which ought to be given early. But one thing must be remembered: these house scraps and peelings are only good if mixed fresh, in a pan kept clean: when allowed to wait, or get sour, nothing can be worse. Bran may be used instead of sharps now and then if the latter cannot be had, but it is too poor to keep on with, and liable to disorder the bowels. Barley meal is better, but the sharps is best of all. The daily boiling up of the peelings and things will be some little trouble for some one; but it should be remembered that by doing so we turn into the choicest food the most unwholesome part of what would otherwise go into the dust-bin and contaminate the air. However, if done at all, it must be done regularly and wholesomely; if not, the whole lot gets sour and rancid, and no one can answer for the consequences to the poor fowls—the most probable result being mysterious deaths from inflammation of the bowels. Unless it can be done properly, better leave it alone, and feed in the morning simply on sharps mixed with barley-meal, with only enough hot water to make a *friable*, not clammy, mass: the rule is, that a big ball of food ought to break easily when dropped on the ground. Keep one saucepan for boiling, and one bowl for mixing the food, and scald both about twice a week. If this is done rigidly, all will be kept sweet and wholesome, and it will soon become a habit and almost get done of itself, as all good habits do in time. Scald the feeding-pan also now and then, though this is not so important as the other.

As to how much the fowls ought to have, there is no safe regular rule, as the same bird wants more when laying than if not laying. The only good rule we know of is to give them as much as they will eat ravenously—*run for* eagerly from end to end of the place. Not as much as they will eat, by any means: they would not only cost too much, but get too fat and stop laying, and finally get ill. It follows that for a while at least they must be *watched* when feeding; till you have got a good idea of what is wanted, it will not do to put a lot down and go away. As soon as ever they seem to take it rather quietly, and *before* they really begin to "pick over" the food, it is time to stop. After a few mornings the average quantity will be seen; but it is a real pleasure to stand by, and throw bit by bit; and it gives any weaker ones a better chance.

This direction as to feeding is very important. One class of people cannot succeed with fowls because they never feed or attend to them regularly at all; another class fail to succeed because they feed them far too well. Not to give too much is absolutely necessary both to health and laying, and also to keeping the place clean; for food left on the ground soon makes the whole place disgusting.

So much for breakfast. They will want another feed in good time before going to roost, and this should be grain. Almost *any* grain will do *except* Indian corn or hemp-seed. Do not be tempted to give maize by its cheapness, or hemp-seed from the fondness of the fowls for it; both are far too fattening, and make the fowls ill and lazy. The best way is to change every now and then. Nothing can be worse than to buy "mixed" corn; the birds get no change then. Good barley, sound wheat, buckwheat, *dari*, heavy white oats (and no other sort), all are good; and it is a good plan to give one for about a week, and then another. The fowls would eat greedily of the fresh one if allowed; but they must not be allowed. Here, too, you must limit them to keen appetite, as measured by the *last* grain given, and taking care especially never to let them get their crops filled *tight*. A pretty fair rule can be given for the corn. Let a woman with an averaged-sized hand take up a handful of *barley*, with the palm downwards (not lifting with the hand underneath). That will be about the measure for a fair ordinary-sized fowl, adding a *little* more for a large breed, and diminishing for small. It will seem too little, and the fowls would eat twice as much—but never mind that. You should have them so that they look smart, hard, and healthy, ready to fly up in the air every time their food is taken to them. If they are so and yet not poor, they are about right, and it is only cruel kindness to them, and loss to the owner, to give them more.

That is the main part of the feeding. They only want these two real meals a day. But there is one more very important thing. If they are penned up in a shed, they must have *some sort of green food every day*. Not that to miss just one day now and then will be a very serious matter. But, on the other hand, just to give green food now and then as it happens, is not enough; so regular as to be practically every day it must be. Fowls cannot be kept in health without this; they are grazing creatures. At liberty, they need no care about this; but penned up, it must be supplied them. Turves of grass are the best and cabbage-leaves the worst that can be given, but even the last are far better than nothing. Where there is a kitchen-garden, the refuse of that will do; where there is a lawn, the grass-cuttings (given fresh, before dried) will do nicely. Or a boy can cut fresh grass every morning, and give it cut into lengths an inch long, with a pair of shears, cutting of course a bunch at a time. Of grass they cannot have too much, so long as they eat it. Cabbage leaves should be limited to a leaf each fowl, and the refuse regularly cleared away. If nothing else can be done, turnips or mangolds must be got and minced up into dice a quarter of an inch square. This will answer tolerably, but not so well. Perhaps the supply of green food is the most difficult duty with town-kept fowls.

Penned-up poultry must further be supplied with material for egg-shell, and *teeth*. Hen's teeth are the small stones and gravel they swallow, which grind up the food in a wonderful live mill called the "gizzard." If the earth is not very fine, there may be enough in the shed; but as this may be fine and sifted, there must in that case be a small space covered, or a pan filled, with gravel for that purpose. The hard place where the food is placed may be thus covered. For egg-shell, get some old mortar and pound up, or some *old* slaked lime beginning to turn hard; or, when possible, get some oyster-shells and pound up small—raw, we mean, not burnt, except just a very little, to destroy all particles of the mollusc, which might flavour the eggs. Half-burnt bones may also be pounded. Any of these things can be given in a heavy flower-pot saucer.

There is only one more thing about this part of the matter. There must be fresh, clean, cool water every morning, placed where the sun cannot reach it in summer. Sun-warmed water is very injurious, and often causes diarrhoea or even cholera. Snow water in winter, by the way, is also injurious; no one knows why, but it makes fowls very thin.

GENERAL MANAGEMENT.

It is generally best to keep a cock with the hens, if possible. They will lay without, but they never seem so quiet and contented, and there is generally much more quarrelling without one. A cock will rarely annoy the neighbours by crowing early, provided the house is made quite dark until the window is opened in the morning. Or when purity of breed is no object, a *small* bird may be selected, half way in size between a Spanish and a Bantam, and with a very full tail. The reason for describing him thus is that the crow of such a little mongrel is seldom harsh or too incessant, whereas larger fowls certainly do crow too much for people of quiet tastes. The eggs from such a bird will also almost always hatch well. But if there is any decided objection, it is better to keep hens only than have any unpleasantness with neighbours, some of whom can be very disagreeable.

In very close confinement it is a great point to provide occupation for the fowls. Otherwise there may creep in the disgusting vice of feather-eating, the birds persistently pecking at each other till they get in a shocking state. There is almost no cure for it, for fowls penned up at least; but something can be done towards prevention. A head of cabbage, a large bone with a little picking left on (very little), or other attractive object, may be hung up by a string to the roof of the shed, and will afford much amusement swinging about as it is pecked at. The corn may be scattered into the loose soil of the shed, so as to give scratching. A perch or two put about, or a small shelf like those used for performing lions, will also give occupation and variety of exercise. But, above all, attend to the cool water supply in summer. The habit is not common by any means, but is so tiresome whenever it does occur, that these precautions may be as well. Cross-bred or common fowls seem free from it, and Spanish and French fowls most subject to it.

As to the general plan of the year, if no chickens at all can be reared, it is simple enough. You start in spring by purchasing the pullets required, hatched the preceding year. These will be almost sure to lay fairly well until autumn, when they should be either entirely or partly replaced by pullets hatched that *same* spring, and *early* in it. These will lay more or less through the winter. Only an unusually good layer ought to be kept at all till next year, all others being discarded; and no hen at all ought to be kept more than two years. This is another thing very important, and which many people forget. The same plan is to be followed always; purchasing in the spring the few birds wanted, hatched in fair time, but not too early the year before, for summer laying; and every autumn killing all but the best layers, and buying a few of the same spring which are early, for winter layers. The two purposes are distinct, and to have eggs regularly must be kept so, as the very early birds which lay in winter will have partly worn themselves out by spring, and not lay so well in summer as those of a later date of hatching.

This system must be mastered, and adhered to, if profit in eggs is the object; especially never keeping a fowl more than two years, and never one that with fair treatment is a bad layer. Some may have become pets, no doubt, and it will be decided not to kill them. Very well. So you can pet an old dog if you like; but you do not expect *profit* from him. That is just it; and so long as you do not expect profit from the pet fowl, we have nothing to say against it; only clearly understand that you are keeping it as a pet, and that profit is out of the question. If you keep an unprofitable hen because she is a pet, the pure business element is gone, and you have no right to expect the same profit. We explain this, because it is a mistake many make, and it is important to clear it up. Keep pets, and you *have* your pets; but if you want profit—eggs—you must at killing time

put that aside, and be governed by purely commercial principles, as the grazier is.

There is a little trouble in buying fresh fowls twice a year, as on this system is necessary; but it is very little, and is the *least* trouble of any way it is possible to manage. The hens done with will not be too old to be good eating, or too many to be otherwise than a treat in any other but very well-to-do households. As to getting the new ones, where experience has already shown fair dealing, the best plan will be an arrangement in advance with the same source, if possible, for the required birds. Such an arrangement will be a convenience for both parties, and keep all going smoothly with the least trouble possible. Those who can hatch their chickens at home will find full directions a little farther on.

Keeping clean has been already insisted upon. The handiest tools for the fowl-house are a housemaid's dust-pan, strongly made, and a short-handled hoe or scraper. You can scrape up all from the shelf or hard floor in a moment, and a sprinkle of sand makes all right, not forgetting now and then a sprinkle from the dredger or carbolic bottle in the corner. The shed is more tiresome, but it must be attended to. It is not much to do after all. The writer, though engaged in business all day, has kept clean a range of houses and sheds sixty feet long, and so clean as he never could get any "man," later on, to do it for him. The more trouble taken here, the less with the fowls.

What else? Nothing. This cleanliness, with regular green food and other attention, with the system described as to ages and stock, will give the young poultry-keeper success and eggs. Nothing has been mentioned but what is really necessary; and if any of the points are shrunk from, it will be best to give up the idea of keeping fowls altogether. Especially do not forget about the quantities of food, understanding that the birds are to have *nothing* but the two meals described, except green food, of which they may have almost any amount that can be given *regularly*, though occasional excesses only are very injurious, causing sometimes severe diarrhoea.

CHICKENS.

Where there are any young children in the family it is always well worth while to have a brood or two of chickens, for the sake of the exquisite delight these chickens will give. Forty years have blotted out many childish memories, but there stands out still to-day, as clearly as ever, the thrill of ecstasy with which, for the first time in life, our young eyes beheld eight little heads peeping out alive from under a hen—our first brood being a fairly lucky one. Long years after that we have stopped to watch chickens by the hour.

The first step to chickens is a broody hen. If a non-sitting breed is kept she must be borrowed or hired, in which case have her brought quietly in *the dark*, in a basket, with an egg or two under her—not tucked under any one's arm. If she is put in after dark, and left for an hour quietly before being carried, she will settle down. The nest should be ready for her; and keeping the light as far off the nest as will give just light enough to see by, put her quietly on with some nest eggs under her, and shut her in. After an hour, but still in the dark, take away the board that confines her, and leave her to come off by herself, with food and water within reach where she can see them as she steps off the nest. There is scarcely ever any difficulty with strange hens managed in this manner.

It is best if the hen can be set away from the other fowls, where she cannot get to them nor they to her, where she has a yard or run, but is not tempted to range too far away. A clean dry dust-bath *must* be near; and if she is thus suited, when she has once found her own way back to the nest she may be pretty safely trusted with the real eggs. If she is by herself, so long as barley and

water (sitting hens should not have soft food) are always by her she may be left pretty much to herself. But if she is set in the fowl-house, or if there are more than one, it is best to take them off at the same hour every morning, gently lifting by the wings, and when returned the nest must be fastened up and the other fowls may be let in. It can be managed in that way, penning the others into the shed from the house, and opening the house door into the garden. It is almost impossible to manage with the shed alone for all, as the sitter would not get proper food; in fact, chickens could not be reared either. It saves lots of trouble if the hen can have a little place all to herself; though practice and familiarity do wonders, and after years of experience you see people handling fowls easily and quietly, and seeming to have no trouble in making them behave just as they want, where novices only make them flutter and scream.

As to the nest itself, always set the hen on the ground. A box like this (Fig. 16), open at the bottom, and in front all but a strip, makes a capital nest. In the fowl-house it is best set with its back to the wall, when the hen can be fastened in by a board pierced with holes; but if the hen is set in an open yard, it should be placed facing a wall in one corner, rather less than a foot from it, when the hen will be quite screened. A little moisture does no harm, and such a nest will give shelter enough in nearly all cases if there is no danger of flooding.

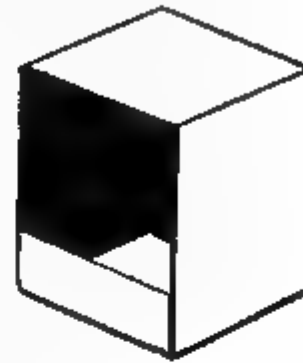


Fig. 16.—NEST-BOX FOR FOWLS.

A

B

Fig. 17.—BARREN (A) AND FERTILE Egg (B).

in a sod of turf cut to fit the box, and lay on that a little straw or soft hay, which helps to keep things cool and moist. It is rather important to mention this, because a good nest for summer would probably addle all the eggs in very cold weather; while a good winter nest would very likely in summer spoil all from over-dryness. More eggs perish from this latter cause than from any other. Before people understood it, they often found chickens perfectly formed in the shells, but dead. After a time, it began to be found out that this was from want of moisture. The wild hen goes for her daily bread among the damp grass, and the nest is always exposed, so they are more or less damped naturally; but a dry and sheltered nest in hot dry weather dries up the egg, and the poor chick is glued to the shell. To prevent this, many people take a small basin of warm water, and sprinkle the eggs and nest every day when the hen is off. This is often rather too much; in fact, you must go greatly by the weather. In wet

The nest will be made up rather differently, according to the season. People who hatch very early, so as to be ready for the shows, must hatch under cover, and put in first a spadeful of dry ashes, and then a thick bed of straw, to keep the eggs warm while the hen is away. The same will do for any cool spring weather. But in very hot weather it is better, after first filling up the corners a little with earth, to put

weather they need nothing; in ordinary spring weather they need nothing till the last four or five days, when the ground may be "slouched" with hot water all round the nest, so as to make a steam. In warm weather we should thus water the ground every other day, or pour some warm water on the corners of the nest round the eggs, but not on them. Only in the very driest weather would we sprinkle the eggs themselves; and then sometimes a day or two before hatching we have poured a good half-pint of warm water over nest, eggs, and all.

If you take an egg, and hold it between the eye and a candle, shading all round with your hand, it will appear translucent, like a faint moon—all over alike. When the hen has sat for eight days you can "test" her eggs this way. All that have no chickens in them at all will appear so still (Fig. 17, A), and should be withdrawn (they will still be good for puddings); but the good ones will show more or less of a cloudy shadow in the middle (Fig. 17, B). The hen will cover better the eggs which are left when the bad ones are withdrawn; or if nearly all are bad, you have time to set her again.

On no account try to feed the hen on her nest, or give her water there, or put either within her reach as she sits. It may induce her to stay on two days, or even three; and then very likely when she does come off she will stay rather too long. Besides, the eggs are not better, but worse, for such close sitting. The regular cooling plays an important part in supplying air to the developing chick; so important, that in artificial incubating machines the eggs have to be withdrawn and cooled, or "aired," for twenty minutes every day. If the hen will not come herself, she *must* be taken off. Hens scarcely ever stay away too long for any ordinary spring weather; but if it is cold, and she does not go back in twenty minutes, she should be gently half-coaxed and half driven towards the nest. It is no use trying more; if she is frightened, she will be longer than ever.

But do not be too fidgety. It is better for a hen to be back in twenty minutes in cold weather—really cold; but there are plenty of instances of eggs being left till "stone-cold," and yet hatching fairly. Attend to her fairly and regularly, taking her off or not, and seeing she always has plenty of barley and clean water, and dust to clean herself in when she comes. But do all coolly and without fuss; and do not worry about her, or be fretting because something seems to have gone wrong. If she stays half-an-hour or more, you can't help it, and all will most likely be right. People who know the most always fuss the least. Last of all, do not give too many eggs to a hen; about eleven of her own size are generally enough.

One thing perhaps may need attention: an egg may be broken in the nest. In that case you must take warm water and a sponge at night, and removing the hen to another nest for a few minutes, clean thoroughly all eggs that are messed, and remove all the dirty and wet straw or hay, adding a little more if needful. Dry the eggs before putting back with a cloth, and examine the hen underneath, clipping all feathers clogged with egg away; else they will adhere and draw more eggs out. If she breaks more it shows she is clumsy, and bodes no good for the hatch; hence it is well not to set very large hens. A nest of eggs is, however, no great matter after all.

Eggs of fowls hatch on the twenty-first day, and of ducks on the twenty-eighth. Long east winds are very injurious, and almost always delay things a day or two. From what has been said before, it will be understood that during the last week or so there will have been a rather moist feel and atmosphere all about, which is the best for hatching. About twelve hours before the chicks are due, it is as well to see how matters stand. Suppose the hen was set Monday night; instead of taking her off Monday morning, it is well first to lift her up gently and see how things appear. The chances are a little chirping noise may be heard, and perhaps an egg or two just "starred" a little (cracked in the shape

of a star). If so, "for this occasion only," it is as well to offer the hen food and water on her nest, as she will not want to come off, and had better not. Sometimes nearly all will be hatched, especially among Hamburgs and Bantams: in that case of course she will not come off, but be fed where she is and shut in again, in the dark, lest she should become restless. Once or twice in the day, if hatching proceeds, it is as well to clear away empty egg-shells, so as to make more room, but no more; and no harm will come of letting alone.

Do not do anything more. Do not take the chickens away, or feed them, or do anything else to them until the first out have been hatched *twenty-four hours*, or nearly. Just leave them in the nest to get strong on their legs and keep warm. For at least that time they want no food, and very often will not eat any. Before that time some of them will, however, be disposed to peep out; and when most of the brood have been hatched pretty nearly a day, offer them food on the nest. Smooth and press down the straw at the front as closely and solidly as possible, and on it put some

Fig. 18.—HEN COOP.

bread and milk rather dry, or some oatmeal mixed crumbly. The very best food of all for the first day, is a hard-boiled egg minced small, mixed with bread crumbs and a very little milk. Put the food on the straw a little at a time, and let the hen call them to it: they will peck it better thus for the first time than if given more tidily. Never mind the nest, as you will be throwing all the contents away soon. Now, if it is night leave them; if morning, and they are all pretty strong, it is time to think of moving them out.

The common open wicker coop is useless except under a shed, or in fine weather, when it does very well on a gravel walk or on a short-cut lawn. In warm weather the lawn will suit the chickens beautifully; but *won't* the hen scratch it up, just! If such a coop is used, a piece of sack or something must be

put on the top and covered by a brick, to keep off the heat. Some sort of shelter will, however, be wanted; and the very best is an open, well-roofed shed with loose or dry dust or rubbish on the floor, from which the chicks can run out at liberty; while about the very worst is the floor of a green-house. They want to be able to run out in the open, in all weathers. Such chickens rarely get cramp in the feet, while those confined often do. Chickens can be reared in a pretty small yard, if they can have a little range to themselves, a little place where they can scratch at not absolutely hard stones, a little sun, and a little care. If there is no shed, a coop that gives some shelter must be made. A sugar-box turned on

Fig. 19.—BOTTOM OF COOP.

its side, and slats nailed on the front, with one sliding one for a door, will make a very fair coop; so will a barrel, or any box large enough. If you have tools and timber, the very best sort is like Fig. 18. It has no bottom, but stands loosely on a separate bottom made as shown (Fig 19) by nailing boards (*a a*) across two pieces of "quartering" (*b b, c c*). The coop fits over outside the floor and rests on the quartering; and the great advantage of the arrangement is that all rain drips off *outside* the floor itself, which therefore keeps dry. To the front of the coop swings a shelter-board, which throws rain and sun well off the front. Chickens with a coop like this never want taking in at night, but may be left out, propping up a board across the bottom of the front to keep them in till early morning, while the same board let down in front on the ends of the floor-frame, does capitally for putting the food and water upon.

In moving the chicks out, place them one by one in a basket lined with something; then take the hen and put her in the coop, and immediately put the chickens down outside the bars, where she can see and call them in. If all are put in together she gets excited, and perhaps tramples them. Then scatter a little food in the coop in front of her—a few grits are best for this—she will see you mean well by her, call them to it, and things will settle down comfortably. After that it is better always to lay a piece of board in front, outside, and put the food on that. Let the hen have a good feed the very first thing.

The secret of rearing healthy chickens is very simple, and not what many people think. There is no particular "best food." Hard-boiled egg ought not to be given more than one day: it is not only expensive, but bad. Perhaps the nearest to a staple "best food" would be a mixture of equal parts of bread crumbs, catmeal, and fresh grass cut small—that is, take a handful in the left hand, and with large scissors cut off very short lengths of green chaff. Mix this with a little water, or for the morning milk, if you can have it, so as to be moist yet crumbly. Spratt's Food for Poultry is capital, and gives very little trouble. Some bread crumb or Spratt should be used for at least three weeks, but after the beaks get strong, sharps and barley-meal mixed will do. Some sort of meal, however, should form the chief food while they are growing, with any scraps of meat that can be spared, cut up very small; and the last feed at night should consist of small grain: grits at first, afterwards dari, buckwheat, or wheat; young chickens will hardly touch barley. Some change now and then is good, and they can have the grain once in the forenoon if preferred as well as at night.

To get *fine* fowls, they must be fed every two hours at first, gradually less after a week, till at two months old they have come down to four times a day. Less than this, however, though it will not rear the largest-sized fowls, will rear thoroughly strong and healthy ones. But now for the great secret—*You must never leave food by them.* Unlike the old fowls, when feeding them give them as much as ever they will eat up at the time, but no more; as soon as they stop, clear every scrap away and scrape the board clean. If you leave it, they never have any real appetite, besides the injury the sour stuff does them. It is a good plan to mix enough of the bread-crumbs and other things for the day, dry, and then mix up enough for a feed with water as wanted. Never forget the green food, unless they can run on grass; if they do, you need not add any cut grass after the first few days, when their beaks are strong enough to crop it for themselves.

The coop must be scraped out clean night and morning, and well covered with sand, earth, or gravel; and the water always fresh and cool. Look particularly after the sun; we have seen it blazing in at noon-day, and the hen almost gasping for breath. After a day or two, give the hen moderate liberty if you can; but free range over a farm is too much for several weeks. In a

yard or small garden liberty is best after a few days so long as there is the coop for shelter. When the hen leaves her brood, it is as well to let the chickens roost in their old coop, bedded half an inch or more deep in clean ashes; they are at home there, and will be happy and contented; or flying breeds may be allowed to fly up near her on the perch, if she is one of the home stock. As a rule, however, they should be more than half-grown before they go to the food and home of the older fowls.

There is, perhaps, one exception to letting the chickens eat all they like, namely, in the case of *wheat*. They are fond of it, and it swells greatly in the crop; it should, therefore, be fed to them with discretion, or the crops may be tightly distended and stop digestion. This is what is called being crop-bound, and in young chickens is almost always fatal.

DUCKS.

Geese and turkeys are not at all likely to be kept by our readers; but ducks, perhaps, may be, and a few words about them may be useful. Of the larger or table ducks there are five domestic varieties. The Rouen is a very handsome duck, large and heavy, and coloured like the Mallard or wild duck, but somewhat richer. This is a good layer. Then there is the Aylesbury, a pure white duck, with delicate pale pink bill. This is the duck so popular in Buckinghamshire, and lays rather early, though not on the whole so well as the Rouen. A great point in the Aylesbury is the pink bill, like the delicate pink of a lady's finger-nail; and as it is very difficult to keep this colour, which turns yellow in the sun, this is not a popular duck. Of late years there has been imported from China another white duck of very different character, called the Pekin duck (Fig. 20). The plumage of this duck has underneath a peculiar canary or cream tinge, and the bill is a bright orange colour. The body is a very peculiar long canoe-shape, which makes them look very well on the water. The Pekin Duck very rarely sits, so that her eggs must be hatched by hens. The Cayuga is a large black duck. The Muscovy or Musk Duck is a very peculiar-looking creature, owing to the development of naked red skin round the head. The drake is much larger than the duck, and appears a very large bird, larger than he really is, as the plumage is very loose; this duck is sometimes pied black and white.

Fig. 20.—PEKIN DUCKS.

Of small or fancy ducks there are many varieties. Some of these are of great beauty, especially the exquisitely coloured Mandarins and Carolinas. The Black East India Duck is also remarkable for the extraordinary green gloss on its plumage.

Ducklings are easier reared than chickens—at least they are sooner independent of the mother. They want feeding often, and their meal should be mixed more sloppy than for chickens. After they are a fortnight old, some kind of corn may be given in a trough of water as a change once or twice a day. They ought to be kept out of the water for about a fortnight, unless the weather is very warm; if it is, they will take little harm. The chief difficulty in rearing ducklings is cramp or weakness of the legs; but this is generally because people, remembering they are aquatic birds, seem to think damp ground or a damp floor is no matter to them; whereas, while in the down, they are as susceptible

to these things as chickens. Young ducks are admirable scavengers of slugs and snails in a garden, but must be kept from strawberries or anything of that sort. As a rule they do no injury.

GENERAL REMARKS.

Cats are often a sad plague to chicken owners, but in most places they can be set at defiance with little trouble and not much expense. If the garden is surrounded by a paling, a yard wide of netting carried above it will be sufficient. A wall may be guarded in two ways. Either lay a yard-wide width of wire net *flat* on the top, so as to project on each side; or what is better still, carry the width upright all round the *inside* top edge of the wall, and the same along the bottom edge of the fowl-house roof. Pussy will walk along and examine, but has not the sense to know that she must get *up* before she can jump down. We never knew this plan fail, and it is much better than having any difficulty with neighbours.

If a hen gets broody it is not desired to set, take her from the nest and put under a coop upon hard ground—not in the blazing sun, of course. Let her have water *ad libitum*, but only moderate food, and let her temporary prison be as far off the regular run as possible—if in a busy place where there is plenty of bustle all the better. She will in most cases soon lose all desire for the nest.

In regard to the ailments and diseases of fowls, much detail would not be useful. It may safely be said that nine-tenths of all cases arise from either (1) cold and wet; (2) over-feeding; or (3) improper diet, especially want of green food.

Colds show very much the same symptoms as in human beings, but if neglected may become *roup*, the most dreaded disease of poultry, which is extremely contagious. Roup may be known by the discharge from the nostrils becoming thicker, and often smelling badly. The fowl taken ill should be at once secluded from the rest, and kept in a dry place free from draught. Get from the chemist some solution of chlorinated soda (Labarraque's) and dilute with twice its bulk of water. Several times a day wash the nostrils, eyes, and other affected parts thoroughly but gently with this. Internally give pills morning and evening made as follows:—

Balsam Copaiba	1 oz.
Liquorice powdered	$\frac{1}{2}$ oz.
Piperine	1 drachm.

Make into sixty pills, adding sufficient magnesia for that purpose. When the first symptoms of a cold are seen, the whole house and shed should be looked over to see if there is any wet place, or particular draught. If there is, it will often be enough to stop this, and to put a few drops of the strongest tincture of aconite in the drinking water.

Sometimes there is a peculiar cankerous growth at the back of the throat of the fowl. This seems to be either a diphtheric form of roup, or true diphtheria, and is, we believe, never found unless communicated by some other fowl. In this case execution is the best and safest course for all but valuable fowls, the disease being very fatal; but we have often treated it successfully as follows:—Give internally twice a day half a tea-spoonful of an ordinary iron and chlorate of potass mixture, and paint the throat with a camel-hair pencil with this prescription: Carbolic acid, one drachm; sulphurous acid, three drachms; solution perchloride of iron, half an ounce; glycerine, half an ounce. The strength must be kept up by frequent small doses of brandy.

If *soft eggs* (eggs laid without any shell) occur often, it is generally a sign of over-feeding. It may often be stopped by half a teaspoonful of Epsom salts, followed by more spare diet and a good supply of the pounded oyster-shells. Too much meat will also cause soft eggs.

When fowls or chickens mope about slowly, scarcely eating at all, but drinking largely, drooping their wings, and getting so thin that they seem to weigh nothing at all, it is almost certain the *liver* is seriously diseased. This complaint is more or less constitutional, and treatment for it is hopeless.

Lameness may occur from rheumatism, or injury, or cramp. In either case, a quiet basket near the fire on some straw, and an occasional rub of the limbs with oil mixed with one-fourth turpentine, will often in a few days restore the patient. Young birds of the large breeds sometimes show great leg weakness, which is different. In this case they must be encouraged to take exercise; giving them a little bone-dust in their food, and half a teaspoonful twice daily of Parrish's Chemical Food.

Diarrhœa may generally be checked by a little chalk on the food in powder. If this fail, six drops of chlorodyne every three hours rarely fail.

Occasionally a fowl becomes what is called *crop-bound*, the receptacle being crammed so tightly with food that none can escape. This can only arise from carelessness in feeding. If taken in time it is generally sufficient to pour a teaspoonful of warm water now and then down the throat, and knead the crop about long and gently with the fingers. It must be both *long* and *gently*—only patience can do any good. After say at least a quarter of an hour of this, put the bird quietly in a basket, on straw, so placed that the crop may be held well up, and leave her for two hours. Then try again, and leave her for another two hours. If *any* visible improvement is manifest after a day, the case is safe, but the fowl must have nothing more till the crop is nearly empty, and then be fed very sparingly on soft food. If all fails, the only remedy is an incision as already described.

Gapes is a very fatal disease of chickens, but not nearly so prevalent as it once was, and never attacks places kept clean from the first. The first symptom is the chicken constantly gaping, but this is not conclusive, as they may *gape* every now and then from other causes. In a real case of gapes, if the beak is opened it will be found the windpipe is infested by several small reddish worms, which cause the choking sensation. How these worms enter the trachea is not yet known; but they are usually associated with some large insects found on the heads of chickens, and it seems probable that these insects act as hosts or carriers during the early stages of the parasite, and convey it to the nostrils of the chicken. In any case, the removal or death of the worms effects a cure. One way is to strip a feather all but a little at the tip; to introduce it carefully into the windpipe, and then draw it out with a twirl, which will bring one or two of the worms when properly done. Some people are clever at this: with others the windpipe is so irritated and bruised by the feather as to cause death afterwards. But the feather plan is a sure cure in the right hands. Another method is to place some carbolic acid in an iron spoon and hold over a lamp, and hold the chicken's head in the fumes. This too is very effectual, but also a ticklish business: as you have to kill the worms without—quite—killing the chicken. Camphor in the water is a help, and to some extent a preventive.

Moulting is not a disease, but at the same time is a considerable strain on the fowl's constitution. It is a great error to give much *more* food, as some do: a fat fowl never moults well: and it is equally a mistake to give constant stimulants. It is well to put a piece of sulphate of iron the size of a nut in a quart fountain, and a very, very little more meat may be given. Care should also be taken to see the fowls are in nice healthy condition as August draws on: and if either

very plump or very spare, a little change in diet may be made accordingly. Special care is also needed at this season to guard against cold draughts or dampness. But more is hurtful and unnecessary.

Let your fowls have the benefit of method, constant care without fuss, and common sense; and on the whole they are pretty sure to do well.

One more hint. Young people should not have the *killing* of fowls. But if a fowl or chicken *has* to be killed by an inexperienced person—and it is sometimes necessary even to put a diseased or injured creature out of misery—the surest and most merciful way is to chop off the head at once. It is not the proper way, or a sightly way; but this way demands experience and skill, and the other will be in young hands, or any amateur hands, much the best.

PIGEONS.

THERE are few pets which give so little trouble to keep and rear as pigeons, owing to the fact that they bring up and feed their own young until these are forward enough to provide for themselves. Cage-birds do the same; but in their case rearing in confinement seems attended with many dangers and mishaps, whilst pigeons hardly ever go wrong or give trouble, except in the case of certain highly artificial “fancy” varieties. The more naturally-shaped breeds, if healthy, give hardly any trouble at all, when once their ways and habits are understood; and every boy should at least begin with such, in order to gain the necessary experience without too many preliminary difficulties.

First of all, it will never do to *crowd* the birds. If only a small space is at command, one good healthy pair of pigeons will rear more young in it than several pairs. A room, or part of a room, of good standing height, and six feet square, will fairly accommodate about six pairs of breeding birds, and not more—less even than that, unless the young ones, as they grow large and independent, are either sold, eaten, or can be drafted out somewhere else away from the parent loft. This will give a fair idea of the space required. We purposely say nothing about the common pigeon-cote on a wall or at the top of a pole, for three reasons. The first is, that there is really nothing to be said about it; the pigeons kept in such a place may have food sprinkled once or twice a day, but otherwise must just be left to do the best they can. The second reason is, that only common and very hardy pigeons can get along in such places. The last and chief reason is, that there is little pleasure in keeping pigeons in this manner; they remain wild and cannot be tamed, and handling them is almost impossible. They are, in fact, simply “property” but not “pets.”

The pigeons are not meant always to live in this space; they must besides either fly out at liberty or have a wire-enclosed aviary outside in which to take exercise. It does not cost very much to enclose a place twelve feet long and six high and six wide with wire netting, and such will do very well. This aviary should have a shelf about four inches wide placed all across, near but not touching the wire at each end, and say four feet from the ground, which will give exercise in flying the whole length from one shelf to the other. The floor of the aviary should be raised a little with bits of brick or tile, and covered with lime and sand or some other kind of concrete, so as to be easily cleaned. It needs no other furniture beyond a shallow pan of zinc or anything else for the pigeons to bathe in, which is necessary, as they are exclusively *washing* birds. This bath may be three or four inches deep, and for six pairs about two feet square, the water being renewed every morning, and deep enough

to bathe but not to drown in. In the cold six months the bath need only be allowed every other day, but must always be *clean*.

The inside of the loft will want more fitting up. The simplest, easiest, and best way of making the nest-places is that shown in the engraving (Fig. 21). Our loft is supposed to be six feet wide. All across at the back are fitted shelves a foot wide and about fourteen inches apart, with an upright partition down the middle, dividing them into two sets of shelves, each three feet wide. Then four boards, nine to twelve inches wide, are nailed over and across all the ends of each set of shelves, screening off a sort of apartment at each end of each yard of shelf, and leaving the middle part open. The engraving will make this quite clear. The bottom space, on the floor, had better be at least fifteen inches high, and be left open, to receive a water-fountain and grain-hopper, which will be kept by the shelf from the droppings of the birds. Each length of shelf will be a home for one breeding pair of pigeons, which will in turn require both ends or nesting-places, as presently described.

Fig. 21.—PIGEON NESTS.

Along the sides of the loft should also be fixed perches for the pigeons, which otherwise must roost in the nest-places. There are many plans for perches, but that in the engraving is one of the best (Fig. 22). A piece of board is nailed along the wall horizontally, and into it are screwed or glued pieces of thick broomstick so as to project about five inches, twelve to sixteen inches apart; if nearer, quarrelsome birds can peck each other. Underneath these perches are fixed slanting boards projecting a shade farther, which keep off the droppings from any pigeons underneath. This board can be cleaned in an instant by one stroke of the scraper, and the whole looks neat and ship-shape, yet is easily put up. Some people prefer flat pieces of wood to the round perches, on the ground that a pigeon's foot is flat; but we found where we had both that the pigeons themselves seemed to prefer the round perches.

Fig. 22.—PIGEON PERCHES.

The loft should either be painted, and then scrubbed at intervals with carbolic soap—say twice a year—or periodically whitewashed with hot lime. If more space is at command, it may be as well to remark that much greater success will be attained by adding to the number of small lofts than by keeping more pigeons in one large one. All experienced pigeon-breeders agree in this conclusion.

The best way to avoid fleas or other vermin is to cover the floor of the loft with coarse pine sawdust an inch deep. If only sprinkled on the floor it blows up with the fluttering of the wings; but this is not the case when laid down thickly. When sawdust rich in turpentine cannot be procured, any pine sawdust may be made to do by kneading up in it a little spirits of turpentine. If the sawdust has the droppings raked off it every day or two,

it may be left for three weeks or so before being renewed. Another method of keeping away vermin is to hang up in the loft a small open phial containing bi-sulphide of carbon. This plan is perhaps the most effectual of any; but the smell is very unpleasant, and the vapour so highly inflammable that a loft so protected should never be entered with a lighted candle. Sometimes sawdust cannot be procured. In that case coarse sand or gravel is the best substitute; but the loft must in this case be cleaned oftener, and it is advisable to sprinkle turpentine, paraffin, or carbolic acid about occasionally.

The shelves and all parts fouled by the droppings of the birds must be scraped clean occasionally. A triangular scraper, like that in the engraving (Fig. 23) is best; besides having three useful edges, it can penetrate corners which a square scraper would not reach.



Fig. 23.—TRI-
ANGULAR
SCRAPER.

FOOD AND FEEDING.

It is well to understand clearly *why* it is advisable to feed pigeons rather differently in winter and summer. The birds (both of them) feed their young by pumping up from the crop a kind of pap or "soft meat," which after a week is gradually changed to grain in a less and less dissolved condition, until at last mere moistened grain is given. Through the breeding season, therefore, a proportion of comparatively "soft" grain is essential to the young ones getting sufficient food; and if the old birds were fed solely upon hard old beans, they might have abundance and yet the young ones be starved. In cold and damp weather, on the contrary, too much of such soft grain is very apt to cause diarrhoea. Hence we give to pigeons in confinement rather harder diet in winter, and softer in summer. Those at full liberty, being more robust in character, and making for themselves a wide selection out of doors, need less care in this respect.

For pigeons in confinement the permanent staple of diet, such as bread is to us, should be good grey peas. The ordinary white peas used for soup suit some pigeons, especially such as are at liberty; but on others they act as strong laxative medicine, and are therefore unsafe. The best grey peas are covered with a kind of fine marking, whence they are often called "partridge" peas; they should be full and plump, though sufficiently old. In winter these peas may be changed for small sound tick beans, and either should be mixed with about one-third of large full tares; a little good barley may also be added. In summer beans are too hard, and the food should consist of half grey peas, the other half of wheat, small maize, or dari, often called Indian millet, a small white grain resembling pearl barley in appearance. Very small pigeons cannot swallow beans, or even the larger peas; such must have the smaller peas selected for them, with a few tares. In making any change of food, do so very gradually. If the change from winter to summer diet were made all

Fig. 24.—ALLEN'S HOPPER.

at once, the result in most lofts would be violent diarrhoea in at least half of the birds. The grain withdrawn, and that added, should be so dealt with by degrees, taking a week or ten days to complete the process, and even before that giving occasionally a little of the new grain.

Pigeons are passionately fond of hempseed, but there cannot be worse grain as regular food. A handful now and then among the whole acts as a stimulant, and a little is useful for matching birds, also as an occasional restorative; and a few grains now and then make a good help in taming a bird. But avoid hempseed *as food*, and most carefully avoid any over-stale, worm-eaten food, which is almost poison. Small seeds like canary and millet are much relished, and very useful on occasion, in teaching young ones to feed themselves, or getting them a meal. If a pair of young ones seem badly fed in the morning, for instance, a good feed of these small seeds, with a little raw rice, to the old birds will often cause the young to receive within an hour or two a good meal.

The food should be given in a hopper of some kind, so made that the birds cannot foul it by their droppings. Various hoppers are made which fulfil this condition, and the purchaser will probably have to take whatever is attain-

able; but one of the best for a small loft is that shown in the engraving (Fig. 24): the round form being suitable for the centre of the room, while the flat model is better suited for placing at the back, under the lowest shelf. In both shapes the grain is thrown forward to the feeding holes by a sloping bottom inside, and the hopper filled from the top. If a hopper cannot be purchased, one may readily be made on this principle from thin wood.

Fig 25.—DRINKING
FOUNTAIN FOR
PIGEONS.

Water may be given in the ordinary make of poultry-fountain, with a hood over the trough. A very excellent pattern shown in the engraving (Fig. 25) is also made in metal.

Mice in a pigeon-loft are very troublesome. They eat a deal of food themselves; but what is worse, their excrement and the "mousy" smell and character of the rest seem a sort of actual poison to the pigeons. If they are found they must be checkmated, and this can be done pretty easily by placing a round hopper of grain on a round table just large enough to give the pigeons standing room. This table must be supported by a single stem of smooth brass pipe, eighteen inches high. To make assurance doubly sure, or if such a height is inconvenient, a round can or bucket, just large enough to slip over the table, may have its sides cut round to about six inches deep,

Fig 26.—PIGEON HOPPER
PROTECTED FROM MICE.

and then inverted over the table, the hopper being placed on the bottom, as shown in the figure (Fig. 26). It will be obvious that no mouse can possibly reach a hopper guarded in this manner.

Pigeons at liberty eat all sorts of things besides grain, such as grubs and small worms. In confinement it has been found that some will eat minced meat

or fat; while boiled potato, bread and milk, crumbled oat-cake, and other such things are relished by others. On these things there is one general remark to make, viz., that such variety is decidedly beneficial if maintained with tolerable regularity, but that merely occasional indulgences in such things may do considerable harm. To green food this especially applies. There can be no doubt that pigeons at large eat it, and a turf or a lettuce every day or every other day may do great good; but it is better to give none at all than only occasionally, which might cause violent diarrhoea.

There is one extra component of pigeon diet, however, which must on no account be omitted. Every one knows the propensity of all pigeons to peck at old mortar and their fondness for salt, and there is a craving in all pigeons for something of the kind which must be constantly supplied. Take, therefore, equal parts of old mortar pounded, coarse sandy gravel, and loamy (clay) earth, and to a gallon of the mixture add half a pint of cummin seed and half a pint of coarse bay salt; mix the whole with strong brine into a mortar, and keep it constantly supplied to a box having a long horizontal slit near the top of one side, large enough for the pigeons to get their heads through, but not to get in, or they would tread down the contents hard. This, or something like it, is what pigeon-fanciers call a "salt-cat," and is *absolutely necessary* to health and good-shelled eggs. Some prefer to mix a pint of salt instead of half a pint, and give the mixture crumbly and dry as fast as the pigeons eat it. When old mortar cannot be found ready to hand, slaked lime will do instead; but it must be *old-slaked*, which is gone hard and requires to be pounded up again.

This is all that pigeons require in the way of providing. Keep the fountain supplied daily with clean water; also the bath. See that the hopper is never empty, and that the salt-cat and gravel-box are never bare. Do this, and clean up everything regularly, and the pigeons will be, as a rule, healthy and happy, and, unless of certain "fancy" sorts, give no further trouble.

BREEDING AND REARING.

Pigeons are naturally pairing birds, and if left to themselves usually remain mated from year to year. The parental instinct is unusually strong in them; so much so that when proper mates cannot be found, two cocks will often pair in some sort of fashion, sit alternately in the same nest, and if a pair of eggs be given them, sometimes hatch and rear the young in a most exemplary manner. Two hens will pair and sit in the same way. It is, therefore, very necessary to be satisfied that the birds are really pairs of cocks and hens, and then not to disturb them through the whole breeding season. If one of the birds dies, another mate should, if possible, be supplied. An unmated hen will do little or no mischief, but a solitary cock will often do a great deal, perhaps upsetting the whole loft by his quarrelsome endeavours to force his attentions where they are not wanted. Such a bird, therefore, should be shut up till a proper mate can be found for him.

How, then, can we distinguish cocks from hens? Unfortunately there is no absolute sign. In general the cocks are thicker about the head, neck, and beak, and more robust altogether; but a strong hen may surpass a weakly cock in any of these points. The voice of the cock is also most powerful, as a rule; and again, as a rule, the gestures are different, the cock pigeon strutting, while the hen bows or curtsies. But some vigorous hens behave in these respects almost exactly like cocks, and the most experienced fanciers have been deceived again and again in particular birds. As a rule, however, these general characters will suffice, especially if the bird be placed for a few minutes in a cage with another whose sex is known.

In the selection of stock there should be no attempt *at first* to obtain specimens of really first-class "fancy" birds, such as win prizes at shows; unless, indeed, the purse be unlimited, and there is experienced personal aid on which to rely. In the first place, such birds are generally much more delicate and difficult to rear, and should not be ventured upon till experience has been gained with others of less value; and in the second place, success with them depends on very special knowledge, only to be picked up amongst "fanciers" of such birds, by very special study of books devoted to the subject, or at the shows which are constantly being held. If the reader's fancy is drawn to one or other of the varieties presently described, there is no reason he should not keep that pigeon; but he should make no attempt *at first* to obtain any very extra quality of it. Let him resolutely declare to the shopkeeper or vendor to whom he applies that he only asks for *hardy young birds that will breed*, which are truly bred, and cares not how deficient they are in this or that "property." Such birds will not only gradually train his eye to see what the points of the variety are, so that by-and-by he may judge for himself, just as well as those of a better quality, but he may very likely get by such a procedure pigeons quite as good as would have been sold him at the higher price. He should know that really high-class pigeons are constantly changing hands at from £5 to £50 a-piece; that such are the exceptions always; that even birds seriously faulty in one or more points, but known to be capable of being relied upon for others, are often bought at high prices by breeders who know their special value; and that, therefore, a mere ten shillings or a sovereign extra over common prices from an ignorant purchaser will be almost safe to represent no extra value at all. To put it in plain words, an experienced fancier may get a very valuable, though very faulty, bird—say a Carrier—for £5 or less; but the novice will probably get no better bird for forty shillings than he would for ten, if he asked for simply a young and healthy bird of the same variety, and frankly stated that "fancy" points of excellence were indifferent to him.

Of the varieties presently described, those which give most trouble to rear—requiring either nurse-parents of a hardier sort or feeding by hand—are Carriers, Barbs, Pouters, Short-faced Tumblers, Owls, and some Turbits. Most of the others bring up their young without difficulty, which is caused in the cases named by the unnatural proportions of the feeding organs—beak or crop—which the efforts of fanciers have produced. Common dove-house pigeons are the hardiest of all, but are apt to be exceedingly wild, which diminishes the pleasure of keeping them. The next hardiest are Homing Pigeons, or those Antwerps (as they are sometimes called) which are flown with messages, the pigeons now called Carriers having nothing at all to do with this work. A variety of Antwerp, bred for fancy points, is nearly as hardy as its flying relative, and being a very handsome pigeon, makes a good start for a boy; whilst birds of either Antwerp class will make capital nurses for any other large-beaked pigeons.

It is much the best to separate most pigeons during the winter, as otherwise they are apt to form attachments it is very difficult to break up, and sometimes pine away if one of the pair dies. It is also better for their health, as if left together they begin breeding earlier than is advisable, and keep on too late. Here is the principal reason for having even a small loft in at least two divisions. As the breeding season approaches, the two birds it is desired to pair are put by themselves into a cage together for a few days. Regular fanciers make a pen with an open partition of wire, so that the two birds can see each other before the partition is withdrawn and they are allowed to meet. This plan is sometimes necessary in a large loft, as cases occur in which one bird—generally the hen—is very sulky at first, and may thrash the other instead of making friends; the partition then keeps them from fighting till the first resentment has worn off.

But this is not very often necessary, and any large cage or pen will answer most purposes. If a bird has been mated previously, it must be kept by itself, out of sight of all other pigeons, *and especially* from either sight or sound of the former mate; a pigeon whose mate dies should also be secluded for a few days before any attempt is made to re-match it.

Unless all the pigeons are allowed to remain together winter and summer, which it has already been explained is not a good plan, each pair of birds ought to be matched in this way, and turned pair by pair into the loft. The object of this is to allow each pair to select quietly one of the vacant shelves or nesting-places, which will for the season be its own particular home; whereas, if a number of pairs are turned in at one time, there will probably be much quarrelling and mischief. Pigeons once thoroughly matched and turned in judiciously will



Fig. 27.—NEST-PANS FOR PIGEONS.

generally remain quiet and faithful throughout the season. They should, as a rule, be paired in March—early or late in the month, according to the

weather; and the best time to separate them is as soon after the end of August as they have done with their then pair of eggs.

As soon as the matched pigeons are turned into the loft for breeding, nest-pans must be provided. Much the best are those made of earthenware, which can generally be bought at pigeon-shops in large towns, or a dozen will be made at any pottery. The exact shape is not material; two common forms are shown in the engraving (Fig. 27). They are made thick and heavy, so as not to overturn if a bird perches on the edge, and the size across will be from seven to twelve inches, according to the size of the pigeons kept. For the larger sizes at least the shallow form is best. Two of these pans must be provided for each pair of pigeons, placing one in the shelter at each end of their shelf, and filling them an inch deep with the coarse pine sawdust already mentioned. If no sawdust can be got with plenty of turpentine in it, the lighter sort may be made to do by rubbing a little spirits of turpentine into it. The very fine sawdust made at some mills, however, will not do, as it gets into the eyes of the young birds: it must be coarse in the grain, and is then the cleanest and best filling. Birch twigs also make very good bedding, and also keep off vermin by their smell; they can be got where there are besom-makers.

From one to three weeks after matching the cock will begin to appear very anxious, seeking every occasion to drive his hen towards their nesting-place, and giving her little or no peace away from it. Some cocks are over-anxious about this, but, as a rule, it is a sign the hen is not very far off laying, and the first egg generally appears from two to five days after this sign is first observed. The pigeon lays, with very rare exceptions, a pair of eggs; and almost invariably, when the birds are healthy and all goes well, the first is laid about five or six o'clock in the afternoon, and the second somewhere about two o'clock on the day but one afterwards. Meantime, the hen stands more or less over the first egg, though she does not sit steadily down. The young pigeons hatch on the eighteenth day from the laying of the second egg.

The pair of eggs are in about three cases out of four a cock and hen, and the hen is in such cases nearly always the second laid. Now the first egg, if left to nature, has a little start by the hen keeping it warm as above described: it will therefore hatch some hours earlier, get fed, and be much larger and stronger than

the second one. When there is much difference between two young squeakers (as young pigeons are called), it is apt to go on increasing, as the stronger and more eager will get fed the better, until the weaker one is lost from starvation. To avoid the first cause of such differences, the nest-pans should be examined every night, and the first egg be taken away as soon as laid, substituting for it a waste or bad egg, or an imitation one made of bone, marking each, of course, and keeping the real egg in bran. When the second egg is laid the first is restored, and thus both will hatch more nearly alike. The scarcity of hens usually comes from this cause, and the plan here described will prevent many a loss.

Weakly hens sometimes have difficulty in laying. In all such cases the cock makes matters worse by worrying and driving the weakly bird in his anxiety, and must be at once shut up. Then a tea-spoonful of warm treacle mixed with a little chopped groundsel will often produce the egg, if the hen is placed quietly in her nest-pan. If the hen seems recovered in the morning, the cock may be set at liberty again. It, however, requires experience to understand and manage these cases, and this is another reason for beginning with strong and hardy sorts, which scarcely ever have any such mishaps.

Every pair of pigeons must be allowed to sit and hatch in the place they themselves have chosen. You cannot set them in some other place, as you would a hen. They will generally take up with one of the nesting-places provided for them; but if any hen lays in a corner of the floor, she *must be allowed to sit there*, or that round may be lost, and to lose a couple of eggs often upsets a pair for some time. A nest-pan may be placed on the spot, and often a bit of board or a brick, arranged so as to give a little more privacy, will be accepted if done quietly at night, but no more. A quiet and kind demeanour of the owner at all times, leading to tameness in his pigeons, is a great help always. Pigeons which are tame, and have learnt to know their master as a friend, will let him do almost anything in reason, lifting even a nest-pan with the hen in it causing little disquiet with some birds; whereas pigeons driven about and frightened by wild motions are always going wrong, and breaking eggs in their terror. There should be no useless "catching" in a loft, and when it is desired to catch a bird, it should be done with a quiet but decided dart, which makes no mistake and causes no commotion. Pigeons do not seem to mind being caught in this way; but wild and frequent catching, which sends them flying round in terror, may cause the loss of a dozen eggs in five minutes, or even the death of some birds by rupture of the heart or other internal organs. In fact, when breeding is once set in, the loft cannot be managed on too quiet and orderly a system.

The hen sits all night, mostly coming off about ten in the morning, when the cock takes her place till she returns, generally about two or three in the afternoon. Not the slightest fear need be felt of the eggs being chilled, and no care is necessary during incubation unless in very hot and dry weather, when it is of service to sprinkle the *shelves* (not the nests) with water once a day. After a week the unfertile eggs can be detected, as in poultry, by being perfectly clear when held between the eye and a candle, while those hatching are more or less dark. If a valued pair are found with barren eggs, it is well to change them, if possible, for a fertile pair laid at the same time by coarser birds, to avoid disturbing the system of the better ones; if none such are available, they should be taken away about the twelfth day, before the "soft meat" comes on, and the parents separated for ten days more, to prevent their laying again too soon, which weakens them. Now and then live ones cannot get out of the shell, and may be helped by cracking it a bit with a pin round where the beak is.

A day or two before hatching is due, the peculiar pap or "soft meat" with which pigeons supply their young begins to be secreted in the crop, but is not

fully ready till the proper time. If there are not then young ones to feed it off, the old birds are in a sense "sick" with it, and evidently suffer considerably, their breeding being often completely upset for some time. This is why, if a valuable pair are from any cause deprived of living young ones, they should have others given them; and they will generally take to one even three or four days old.

And here should be well understood the system of bringing up, under feeders or nurses, the young of certain varieties which, owing to either delicacy or some peculiar formation of the feeding organs, cannot bring their own young to maturity. To begin with, nearly all such pigeons can feed pretty well for a week or ten days, and must be allowed to do so for the reasons just given, though it is not always advisable to entrust their own young ones to them. Neither does it answer to exchange eggs, unless they are laid within a day of each other; for it will be easily understood that if eggs were given which are not due till some days after the usual date, the sitting pigeons would "go sick" with their soft meat for a few days, after which the supply would go off; while if, on the contrary, the eggs are hatched too soon, none would be ready, and the young would perish. Fanciers generally, therefore, let each pair of pigeons hatch their own young, and allow these to have the food of their own natural parents for a few days, after which there is much more liberty of action. As a rule, *two* pairs of nurses are provided for every pair of the high-class birds, so that foster-parents may be ready at all times when wanted; and it is then usual to transfer the young pigeons it is desired to rear to a pair which have hatched a few days *after* their own parents. By this means they get a longer supply of the soft, curdy pap than usual, which tends to make them grow larger and stronger. The common squeakers are usually destroyed, but being hardier in constitution, they would often be reared even by the insufficient and harder food of the other parents; and it is much better for these if they can be, giving the hen especially more rest. It can generally be managed by helping the birds a little with hand-feeding, in the way presently described.

Feeders must be chosen with some regard to the breed to be fed. Comparing the very small beaks of Short-faced Tumblers with the immense beaks of Carriers, for instance, it will be plain enough that suitable parents for one would necessarily fail to feed the young of the other. Dragoons make good feeders for Carriers and Pouters, and will also do for Barbs, though Short-faced or Exhibition Antwerps do better for these. For the short-faced or small-beaked pigeons, common Flying Tumblers, or Jacobins, or many so-called Toy Pigeons answer well. Another thing very important is a tame and quiet disposition; and here again comes in the value of tameness through the whole loft. Some birds will allow almost any liberty to be taken with them by one whom they know, and such are invaluable in bringing up valuable stock; so that some fanciers value a proved and tried strain of "good feeders" only second to their more high-class stock. Sometimes a pair of young of a delicate breed are "shifted" several times; sometimes of necessity, in order to make one change, all the young will be shifted through the loft, and a register is therefore advisable. In all cases the change is made to parents a day or two younger at feeding, but such changes should be made at night, and before the plumage is so far grown that the old birds can see any startling difference in colour. With this precaution there is rarely any difficulty when the ways of the birds are a little understood; but we repeat that the young fancier should *begin* with sorts that can bring up their own young, so as to encounter these difficulties of management by degrees.

A good deal can be done by artificial feeding, and this may indeed be necessary at any time through some unforeseen accident. For instance, if the hopper has by any neglect been left empty, the old birds cannot possibly feed their

young, since the soft food consists of the grain partially digested in the crop. If things were left to themselves in such a case, the young might be starved; but it is easy to feed them instantly by hand in the following manner. Chew some kind of plain (*i.e.*, not sweet) *milk* biscuit into a smooth pap, and taking the little squeaker in hand, feed from the lips, into which its beak must be inserted. It will greedily "feel" for the food; and no difficulty will be found if care is taken to insert the beak *sideways*, so that the mandibles can slide freely between the lips, the tip of the tongue pushing the food between the open mandibles. If this method is disliked, the birds can be fed by mashing the biscuit up with warm milk, and giving it through a syringe with a rather large aperture; but this process is much more tedious than the other.

A similar failure to feed may occur at a later stage, when the parents would naturally be feeding with grain simply moistened in their crops. In this case the food must be different, grey peas being soaked all night in cold water to swell and soften them. Before feeding, *hot* water must be poured on sufficient to make them lukewarm, and then taking the squeaker on the lap or knee, with its head towards the right hand, hold it with the second or third finger of the left hand behind the back of the head, while the finger and thumb, or two fingers and thumb, hold the beak open; peas can then be passed down the throat with the right hand, pushing them in with the finger, but letting the bird clear itself every three or four. At either stage the crop should be rather loosely filled, and after a few meals the young ones will eagerly welcome their feeder. Young pigeons can be brought up entirely in this way with no difficulty if their parents sit on them at night as long as may be required to keep them warm, so that there is no need of losing them even should feeders fail; some fanciers, indeed, prefer this method to the expense of nurses. When so reared they become so tame as to be almost tiresome, it being almost impossible to drive them away; but this will hardly be felt as a drawback by most boys, and a great deal of pleasure may be found in thus acting as foster-parents, and watching the young ones grow up to maturity. In all cases, however, it is advisable during the rearing season to examine the crops of all the young ones at night, and if any are empty to fill them up at once. In this way also the puniest squeaker of a pair may often be nursed and fed up till it can stand on equal terms with its stronger brother. It is, however, to be understood that there is, as a rule, none at all of this trouble with hardy birds, unless in the case of some accident or neglect; all they ask is to have their hopper and fountain always supplied, and they will attend to their family without troubling anybody.

Young pigeons, if all goes well, grow amazingly fast: you can see their growth almost from day to day. When a week or so old, the sawdust in the nest-pan should be changed for clean, and again from time to time, always taking care not to startle the old birds, and always putting a young bird taken out to feed, *immediately* back in its pan so long as it remains there; if kept out to "pet" at this stage the parents may forsake it. The young must never be crammed with cold or hard peas till they are old enough to peck a bit for themselves: they cannot digest such food, and they, moreover, need the moisture soaked up until they can drink for themselves. Some young ones are slow to learn to peck, and this especially applies to those which have been hand-fed, which will often have no idea of even attempting such a task long after others are pecking on their own account. Mixtures of *small* grain, like millet, canary seed, and dari, thrown down a handful occasionally, will help in this, and sometimes a little starvation must be tried; in such cases, however, always filling up the poor little bird at evening, and never leaving it more than twenty-four hours without food. We once knew a case where a hand-fed pigeon could not feed at the age of six months, but it is the only one such we remember.

Towards autumn the young pigeons moult, and as they fledge it is not uncommon for some varieties to droop considerably. Much help may be got in these cases by giving every day a capsule of cod-liver oil.

We now proceed to give a brief description of the principal varieties of pigeons; to describe all would exceed the limit of this work. Hints on training Tumblers and Homing Pigeons will be given under these varieties.

VARIETIES OF PIGEONS.

The *Carrier* (Fig. 28) may originally have been the sort employed to carry messages; indeed, it is likely that he was, because Moore (the oldest pigeon writer) seems to think it was so, and because the very similarly-named *Horseman* and *Dragoon* present the same features in less degree, and the *Dragoon* is still a very good Homing bird. But the *Carrier* of the present day is useless for homing, and entirely a fancy bird. He is of bold, upright, racy carriage, very thin and long in the neck, and long in flights and tail as regards his

body; but the chief "properties," as fanciers call them, are in the head. The bare whitish substance round the eye and beak will be noticed, and are called eye and beak-wattle; on their size and regularity of shape, with length of beak, the value of the pigeon chiefly depends. The beak in good specimens measures two inches from the point to the centre of the eye, and should be flesh-coloured, though black is often seen. The eye-wattle should be circular, and is sometimes as large as a florin. The beak-wattle is often more than four inches round, but it is harder to get an elegant convexity, well carried forward, than mere size. Finally, the shape and carriage of the body and a straight beak must be considered. Almost every year one or two of the best *Carriers* change hands for £50 or more; but our caution about prices applies to no pigeon more than this, as it requires much study to understand

Fig. 28.—CARRIER.

them. *Carriers* generally need feeders or artificial feeding. The usual colours are black and a kind of buff-brown fanciers call dun; but there are also blues with black bars, and whites. Duns and blacks are matched together. This pigeon, besides the difficulty of breeding it to perfection, is very subject to several diseases, and should not be bred (except of a coarse, common, cheap quality) by boys till considerable experience with others has been attained.

The *Dragoon* (Fig. 29) undoubtedly sprang from the original *Carrier*, when less developed in wattle than it now is. It is a fine, hard-feathered, racy bird, the usual colours being blue with black bars, silver, white, yellow, and red; there are also fine chequers and grizzles. The head is nearly half an inch shorter than the *Carrier's* to the point of the beak, and the wattles very much less developed, the beak-wattle fitting in with the head to a compact wedge-shape. On the

perfect symmetry of this wedge or "peg-wattle," as it is called, with due proportions in head, beak, and body, the value depends. This pigeon has the great advantage of being one of the hardiest and best breeders of any, and makes, therefore, a capital pigeon to commence with. It also makes an excellent nurse or feeder for any large-beaked pigeon. Common specimens can be bought cheaply enough if our advice as already given be followed out, and will give hardly any trouble. The young birds can be trained to carry messages up to 100 or 120 miles. The Horseman of the old pigeon books has disappeared entirely; it was simply a bird between the Dragoon and Carrier, as much like a Carrier as possible. Since Carriers became more plentiful, therefore, Horsemen have died out.

The *Barb* (Fig. 30) is another "wattled" pigeon, but curiously opposite to the Carrier in properties. It, too, should have a circular wattle round the eye, as large as possible; but while the Carrier's is nearly white, the Barb's is as bright a red as can be got. The Carrier's head is thin and long; the Barb's as

Fig. 29.—DRAGOON.

wide and short as possible, with a short, blunt beak rather turned down. This will be seen in the engraving. The beak-wattle is comparatively small, and should be even and smooth. The body of the Barb is plump and squat, and the short legs give the bird a "duck-like" gait. Barbs are hardy, as a rule, and good breeders, but owing to the short beaks are often bad feeders, and then need help; some do not. The colours most usual are black and dun; next red and yellow. A few whites are seen, but seldom good. The Barb is rather subject to canker and cold in the eye, but has the merit of readily becoming very tame and familiar.

Fig. 30.—BARB.

The so-called *Tumblers* are of many different sorts, but may be roughly divided into two classes, the *Performing* (Fig. 31) and *Short-faced Tumblers*. Of the proper tumbling pigeons there are several sorts, some with feathered legs and

some with clean, and of many various colours or markings; but all agree in having a shortish head and a rather small beak. The tumbling consists of a complete backward somersault in the air, but of this too there are varieties. "Tipplers" make one at a time, "Tumblers" several without stopping; and the

true Birmingham "Roller" turns over and over through a good space like a spinning ball. These performances are gone through at a good height; but there are even varieties which tumble in the house or loft or on the floor.

Much depends on training these birds, even when of a good sort; good ones may be purchased, turned out carelessly, and soon spoilt altogether. The great thing is to ensure the birds being always at work when out of doors, to secure which it is best to let them out before feeding times at morning or evening, or both. They want a high loft or starting-place, if possible, and they should be thrown well up, and be let in to feed as soon as they descend. When flown after feeding they are idle, and likely to settle, which soon spoils them, and the food may be thrown up in tumbling from the crop into the

Fig. 31.—FLYING TUMBLER.

throat, and thus cause choking. If they do not fly well they want keeping in for a few days, and should be let out on some bright day, when they will feel more disposed to take exercise. If they "settle" they are to be driven off, but fed if they come right in, and by keeping up this plan they learn to spend all the time they are let out upon the wing. When got into regular training it is best to fly them morning and evening. It is always necessary to see that only good flyers are let out, as lazy birds inclined to "pitch" may spoil the others, and equally necessary to avoid any attempt to get them down, unless wanted in for good; though after they are in and fed in the evening they may be allowed out for a little to pick up scraps and mortar. It is not well, however, to have birds in too good flying order. They may by regular training be got to fly for hours, and if then a strong wind or fog comes on they may be lost. When once well trained, therefore, they should be got into heavy flesh, and a few birds should always be kept at home, which can, if necessary, be sent up after the others to decoy or lead them home. If these are poor flyers all the better, or even if not flyers at all, the object in such cases being to induce the flock to return at once.

Fig. 32.—BEARD TUMBLER.

Young Tumblers should not be let out till three or four months old. They should then be tossed two or three together, with the same number of old ones kept back for the purpose, into the general flight as they are returning from a fly.

The fresh birds will generally set the lot off again for a few minutes, which will give the young as much practice as they can stand, and gradually accustom them to flying and tumbling. All the preceding directions, it will be seen, refer to *flying only*, which is all that can be taught by training. The tumbling is developed as the bird grows, and if the stock is good will come by association and habit; if not, it cannot be taught. Some develop the propensity very fast, others later, and sometimes these last make eventually the best performers. But there must always be a strict drafting, and every bird found to be an idler after fair trial must be rejected if the loft is to be kept up to a good standard of performance. Some young ones when learning cannot tumble quite over, but fall back from want of confidence. Such should have the tail shortened or the centre feathers plucked; this will remove resistance, and probably enable it to get over. With practice the habit will be perfected, and as the tail grows all will be right. Many good Tumblers have to be helped in this way at first.

Fig. 33.—BALDHEAD TUMBLER.

In starting a new flight, it is well first to get a few common Dragoons or

Antwerps used to fly round the locality; then let young Tumblers be either purchased or bred from parents shut up, and when strong enough, let them out for half an hour daily, hungry, so that they may not go far, but only learn to observe the neighbourhood; they may be tempted in with a little food. Then shut them up a few days, after which let them fly with the Dragoons or Antwerps for a week or fortnight, always getting them in *directly* they return. The other pigeons will by this time have taught them their way about, and should then be parted with, as longer companionship would spoil the Tumblers, and the further training will proceed as described.

For many years strains of Tumblers, shorter in head than usual and with certain markings, have been bred together without any reference to tumbling at all, and thus have been produced the *Short-faced Tumblers*, which have lost the power of tumbling altogether. These birds have a very short skull, with high and

Fig. 34.—POUTER.

almost projecting foreheads, and small beaks—so small and short is the whole, that from eye to point of beak in many birds only measures five-eighths of an inch.

The illustrations show a Beard (Fig. 32) and a Baldhead (Fig. 33) Tumbler; the former has a white cravat under the throat, while the head of the latter is white on the top. In these birds the chief thing is accuracy in the line dividing the colours, and in having the flights on each wing white, with the short face. There are also black and mottled Tumblers; but at the head of this division stands the "Almond" Tumbler, produced by long perseverance in mingling together black, yellow, and white strains, so that each feather in the flights of the wings and in the tail shows *all three colours* when the bird is mature. It will easily be understood that breeding Almonds is a very complicated and uncertain process, a perfect bird being very rare; but it is

carried out on the principle that when any one of the three colours seems deficient, it must be thrown in by introducing a bird containing a greater measure of it. The mass of Almonds are too dark or too light, the difficulty being to produce pigeons with all three colours in each of what are called the standard feathers.

All Short-faced Tumblers are delicate, the Almonds most so, and require nurses, for which purpose common Tumblers are best.

Pouters (Fig. 34) are remarkable-looking pigeons, distinguished by an enormous inflation of the crop and by great length of body and limbs. All pigeons can inflate the crop to some extent. Some birds will measure twenty inches from the tip of beak over the head to end of the tail, and seven inches from the knee or hock-joint to the end of the toe-nails. The body must be slender as well as long, and the legs nicely feathered with soft feathers. The legs are white, there

Fig. 35.—FANTAIL.

is a crescent-shaped white patch on the crop, the flights are white, and there should be a little "rose" of white feathers on the shoulder of each wing. Pouters are a little troublesome, being apt to over-gorge themselves, and many require nurses or else artificial feeding; they are also apt to be weak in the legs; but, on the other hand, they are very tame as well as showy, and few birds take to petting better. There are likewise Pigmy Pouters resembling the large ones, but as small as possible. Pouters seem to breed best upon the floor.

Fantails (Fig. 35) are chiefly white, though there are coloured ones. They are distinguished by a broad flat tail, spread out almost to a circle, and containing from twenty to thirty feathers (the ordinary number in pigeons being twelve). They have a peculiar "carriage" and "motion," the head being thrown back to the root of the tail, and the neck and head moved backwards and forwards with a tremulous vibration. They also walk on tip-toe. They are pretty birds, and unless of very high quality not difficult to rear; but those with very much "motion" are apt to be somewhat delicate.

Jacobins (Fig. 36) have short "bald" (or white) heads, also white flights; but the characteristic feature is the "hood" and "chain," consisting of re-curved feathers, which form a hood over the head and a long ruff down the sides of the neck. On

the length, symmetry, and closeness of these feathers the value chiefly depends. These pigeons give little or no trouble in rearing or feeding their young.

Owls (Fig. 37) are of two sorts, called English and foreign. The foreign are most commonly white, and must be as small as possible; the English are larger, and chiefly blues and silvers; there is also a very peculiar colour in this breed known as "powdered" blue or silver, which appears as if the neck and shoulders were frosted over with hoar-frost or sprinkled with flour. The points common to all Owls are a short, almost circular head, with the beak turned down in the same line as the arched profile, a gullet or dewlap under the throat, and a rose, frill, or purle of feathers on the breast, which the old fanciers preferred circular, but modern ones seem to like better all down the front, like that of the Turbit. The larger Owls often feed well, but if small, or with a very large gullet, they often need nurses; and the foreign Owls are very delicate indeed, taking cold very readily.

Fig. 36.—JACOBIN.

Turbits resemble Owls in many points: indeed, some say the heads and frills should be the same. The general opinion, however, is that the head should be longer, and the beak larger and not so bent down as in the Owl. The frill in this pigeon at least should extend as far up and down as possible. The colour is also different, being all white, except the shoulders or sides of the wings. The Turbit is also crested, either with a pointed "peak" at the back of the head or with a "shell" crest, like the edge of a shell, running round the back of the skull.

There are some Eastern varieties of pigeons lately imported, resembling Owls and Turbits in their main points, which are of very great beauty; indeed, they may be termed the most beautiful in form and colour of the pigeon race. *Turbiteens* are like Turbits, but with feathered legs and a coloured patch on each cheek; sometimes also with another on the forehead. The difficulty with

Fig. 37.—OWL.

these is to get both sides of the face exactly alike, and marked with solid patches free from stray ticks of colour or white. But the most beautiful of all are the *Satinettes* and their sub-varieties. These also have white feathered legs and the

general points of the Owl family; but the Eastern breeders, like the English with the Almond Tumbler, have combined three colours, only with a beauty and regularity of pattern which the Almond does not possess. The colours are pinky-brown, black, and white, and these are combined in various ways, but often with a coloured line round each feather on the wings, which gives a most exquisite effect. In other birds the bars on the wing are of the three colours. Besides Satinottes, Blondinettes, Bluettes, Silverettes, and Brunettes are the chief of these varieties.

Trumpeters have an immense circular top-knot or crest on the forehead, a large shell-crest, and immensely-feathered legs. They are rather large and loose in feather. Formerly they had a very loud call, from which the name was taken; but of late years this has been in a great measure lost through fanciers breeding chiefly for other properties. Trumpeters are usually black and mottled.

Fig. 38.—SWALLOW.

Archangels are chiefly distinguished by a very peculiar iridescent metallic copper or bronze colour. They also have a very sharp-peaked crest behind.

Nuns have coloured heads, flights, and tails, with all the rest white, including a white shell-crest at the back of the head. They are hardy and good breeders.

Runts are the giants of the pigeon world, and have been known to weigh two pounds each. They would beat everything for pies, but are not as a rule very good feeders to their young. The French have some large pigeons nearly as big, which they breed for market, and call *Pigeons Romaines*, which are hardier and much more satisfactory merely for the table.

There is a large number of what are called by fanciers "Toy" pigeons, because their peculiarities consist almost entirely in the feather and marking, with or without the addition of a crest at the back of the head. They nearly all have the small beak of the wild pigeon, and are hardy and easy to rear. To describe them all is impossible. Magpies are marked not unlike the bird of that name; Scandaroons are distinguished by very long curved beaks; Frill-backs have every feather curled back in a peculiar way; Swallows (Fig. 38) are handsome: they have a shell-crest, heavily-feathered legs, coloured heads and wings. *Ice* pigeons are of peculiar beauty, being covered with frost or powdery bloom, with very prettily-coloured bars or wings, some of which greatly resemble in pattern the markings of the *Satinette* tribe. *Hyacinths*, *Porcelains*, and *Suabians* are also

pigeons distinguished by beautiful colours and markings in much the same way. All these beautiful birds have been produced by the German breeders, and it is singular both they and the Easterns should have accomplished the beautiful tri-coloured markings in distinct races, for these Toys quite differ in shape from the Owl tribe already described, and it is impossible to cross one class with the other without spoiling both.

Homing Pigeons (Fig. 42), used for carrying messages, have been perfected on the Continent, where they have been produced by breeding together the best performers out of a mixed race originally founded on three distinct strains. One of these was the old English Dragoon; another a high-flying kind of Tumbler, called the Cumulet; and the third the Belgian Smerle, which from its round head and occasional frill was apparently related to the Owl. As just remarked, the birds are now bred by pairing proved good performers together, and consequently vary a great deal in colour, shape of head, and general appearance, some being much more thin and snipy in face than others.

To excel in this class of pigeon, it follows that the owner must encounter heavy losses in training. He has not only the ordinary risks, but he must make his training severe enough to weed out all but the best birds. His losses are a part of the very process by which excellence is produced. Frequent crossing is necessary to keep up strength and energy, and every cross must be the best that can be afforded. The principle of the whole is quite simple. All pigeons have a strong love of their home, and will fly to it as far as they can; and from time immemorial this has been taken advantage of to make them carry messages. But some breeds have both greater powers of flight and greater intelligence in finding their way, and these qualities being capable of cultivation

Fig. 39.—AREA AND LOFT OF HOMING PIGEONS.

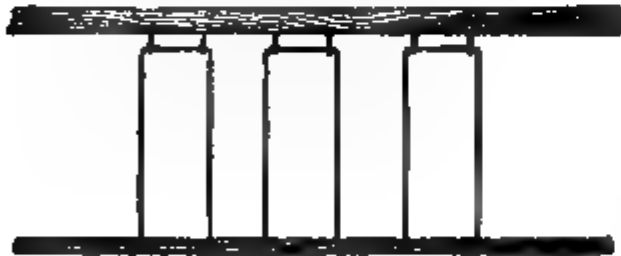


Fig. 40.—BOLTING WIRES.

like any other, a breed is established. Thus, a good pair produces, say, a dozen young ones: of these some are lost in training, and of the rest one pair are found best; this pair will produce a greater number of good Homers than the others would do, and so on.

The loft for these pigeons should be high, if possible, so that they can see it in returning; for there is no doubt whatever that the birds return by sight and

memory, and an easily seen point is a help at the earlier stages. This loft must be provided with a sort of trap, or area as it is called, since birds may return at any time, but must be kept in at pleasure (Fig. 39). The area is a kind of cage, as shown in the figure, outside or inside a hole in the wall or roof. There is a ledge all round it on which the pigeons alight, and if the trap-door be open they enter through the open space, if it is closed they push in the swing-doors or bolting wires seen at each side, which will open inwards but not outwards. The wires here are shown fixed in a spindle which turns on wire centres, but a simpler way is that shown in Fig. 40, where the wire is bent and the head hung in small staples; it will be seen in a moment how the bottoms of the wire resting against a ledge can only open in one direction. Young pigeons soon learn to use these

doors, but meantime they are let in by a slide in the top. By opening this a square hole is left through which the bird can easily drop down, while its extended wings prevent any from flying upwards. The loft must be arranged

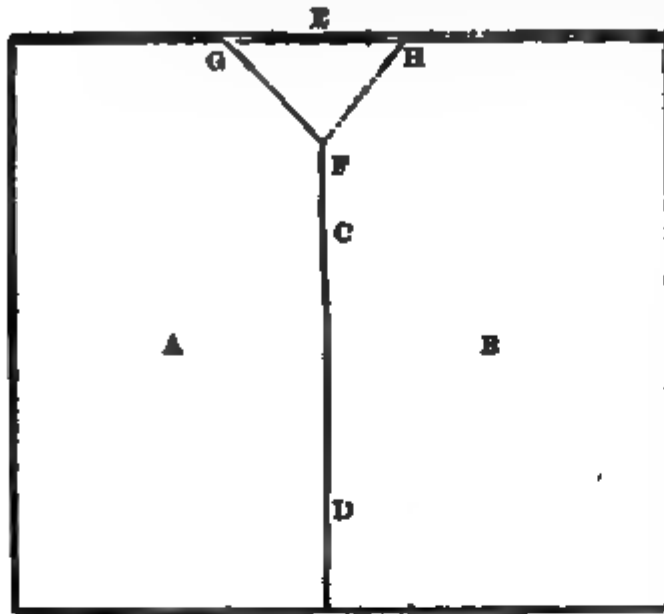


Fig. 41.—PLAN OF LOFT FOR HOMING PIGEONS.

in at least two divisions, so that each can get to the entrance. This is easily done, as shown in Fig. 41, where the two compartments (A, B) are divided by the division (C D), which can be of wire boarded up a foot from the floor. Near the area (E) it forks, as at F G, F H, and a door hinged at the fork, as it is fastened to one side or the other, will give access from the entrance to either, or to both when the door is mid-way.

It is useless to buy old birds to turn loose. If any good, they would be off at once to their old home, for it must be remembered these pigeons *only fly home*. If old ones are bought to breed they must be confined, or all the web may be stripped from the shafts of the feathers on one wing, and the

birds then let out when they have once got young. But it is better to buy young ones that have only just left the nest-pan and never seen the world.

When these can fly, they should first be allowed to view the neighbourhood from the area without being given liberty; then they may be let out after feeding at night with an old bird or two, and after a few days can be let fly round the house. When they know the neighbourhood, they should be let out every morning, fasting, to get a sharp fly and come in *quickly*. They should not be regularly trained beyond this till they are at least three months old, and know their immediate neighbourhood thoroughly well.

The young pigeons may then be taken in a basket, and first "tossed" five or six hundred yards from home, unfed. Toss them steadily, well up, and open the hand sharply, so as to pull out no feathers. They should recognise the place at once and fly home; if not, the sooner they are lost the better. And so of any failure to do a fair training stage: as already said, such birds must be lost.

Fig. 42.—HOMING PIGEON.

Toss them at this distance all round, on successive days if fine, but only when fine; thus they learn the place all round, and the *habit* of making for home after confinement in a basket. They should next be tossed half a mile all round, and then a mile, which will accustom them to any side of their own town. These small stages are best at first to teach the birds and give them really a fair chance; but now the stages must be more severe, but still easy up to five miles all round, always so far on an empty stomach, and never near a building, which might cause them to pitch. Then we should toss at ten miles, and thence by ten mile stages to fifty miles; after that, as it happens, from fifteen to thirty miles apart, and tosses will increase till considerable excellence of the stud has been attained. Every separate route must be trained to stage by stage, and it is no use tossing a bird a long distance on an unknown road. Young birds should not be pressed beyond 150 miles the first season; but good old birds have done 400, 500, and 600 miles. There are many Amateur Pigeon Societies in England to promote pigeon racing, and some of these have kept pretty clear of betting; but it is to be regretted that the abuse has crept into others, and is fast spoiling what promised to be a purely amateur sport.

Of course hens should never be flown any distance in the breeding season, or cocks for four or five days after hatching, as the soft meat would make them unfit. There was a regular pigeon post to Paris during the Franco-German war, the pigeons being sent out of Paris in balloons to be flown back. The messages were set up in type, in four columns, like a newspaper, and photographed small on a film of collodion, two inches long by an inch wide, which was rolled up in a small quill, the quill being tied at each end to the stem of one of the feathers of the tail. (This is the best way to fasten all messages which are on small slips of paper.) Several pigeons were sent with duplicates, in case one was shot, and on arrival the collodion was placed on a slide, magnified by the oxy-hydrogen microscope, and the separate messages transcribed for delivery, the tariff being a franc per word. Lofts are still kept up in France and Germany, in case of military emergencies, which might destroy the telegraphs; and in England pigeons are used to carry messages from light-ships to the shore, and by a few country doctors to carry home prescriptions or orders from wide rounds.

This race of pigeons has been cultivated for the show pen, a massive convex head being the chief point. These birds are called Exhibition Antwerps, and are very hardy and attractive birds, having a peculiarly intelligent look. The prettiest colour of these is a kind of French white, known as silver-dun, a loft of which is one of the most pleasing sights conceivable.

It is useless giving directions for the complaints common to highly-bred pigeons. If such are kept a special hand-book will be studied; and the hardier kinds are little subject to such things. Colds will often yield to a pinch of Epsom salts and shutting the bird up in a warm pen, bathing the legs in hot water and drying every night; or to a few bits of sugar the size of a pea, on which is dropped spirits of camphor. Diarrhoea is best treated with two or three drops of chlorodyne. Wing disease is rather common in confined birds, and seems to show a scrofulous tendency. It shows itself by hard yellowish lumps on the joint of the wing, and should be treated by painting this daily with spirits of turpentine or tincture of iodine, or rubbing in iodine ointment.

CANARIES.

No birds, except pigeons and fowls, have been converted under the influence of domestication into so many distinct varieties as the Canary. The original wild Canary is a greenish finch, much like the English siskin. There are several green domestic varieties, or partially green, but domestication and the choice of breeders have made the predominating colour the well-known canary yellow, which is, however, bred of different shades. It is a singular fact that another largely imported green bird, the beautiful Australian Budgerigar, otherwise called the Butcher-bird or Shell Parrakeet, has also been known to breed yellow offspring in captivity, and will, ere long, in all probability, have produced a permanent yellow domestic variety. The varieties of Canaries are kept up to perfection by numerous competitive shows, at which prizes are offered, and at some of which a hundred Norwich Canaries will be staged in one class. A visit to such a show is well worth while, and will open the eyes of most people considerably as to the variety found in this beautiful bird, which was probably first domesticated about the year 1550. It is now, to all intents and purposes, purely a *domestic* bird, bred for countless generations in captivity, and thoroughly used to cage life. It is accordingly bred in cages with greater ease and success than almost any other bird, and is so bred in some localities—such as Norwich, in England, and the Harz Mountains, in Germany—to such an extent as to bring in a considerable revenue.

We have, however, to do first with the Canary merely as a song-bird. The Song Canary has been brought to perfection in Germany by many generations of careful training and breeding. The very best birds are bred near or at St. Andreasberg, in the Harz district; but many other German districts also breed considerably, as does the Tyrol, which once took the lead. The best birds are hardly ever, if ever, heard in England, for the reason that they are not sufficiently valued in this country. A great Andreasberg breeder, who sold a hundred birds at 9s. each to a wholesale Berlin dealer, sold to the same dealer at the same time his *best* ones at 30s. to £3 each; the dealer would obviously sell at a much higher price; and any one can guess how few people in England would give £5 or £6 for a Song Canary. Those that reach England are the ordinary rank and file; but the song of even fair specimens of these is very beautiful to English ears. The birds are carefully trained, some by older birds which are picked performers, and others by the flageolet, to execute certain trills or passages of melody; and excellence consists in unbroken execution, not interrupted by detached notes, however fine in tone. Some songsters have the wonderful compass of four octaves, and can sing various “shakes” in marvellous style, while each burst of song should, if possible, end off with a soft, flute-like, descending passage. Six months’ training is often devoted to this, and only certain birds have a temperament which can attain perfection, the excitable ones bursting into loud detached notes, which spoil the song—at least, to a German ear.

There is, however, no difficulty in getting fine singers, according to any English standard, from the birds which do reach England. In the autumn, or near the beginning of winter, they arrive, and can be had of dealers in most large towns in little wooden cages; but the majority are purchased only to die very soon, for want of a little knowledge of two things, which we must now explain. In the first place, nearly all these birds are used to having their seed and water *inside the cages* in which they are sold; and many of them, when put into other cages with vessels outside, have not sense to put their heads through, and die of starvation with food before their eyes. For the first week at least their old tins must be kept inside the new cages *as well as* the new vessels outside; and the birds

coaxed on to use these by sticking bits of watercress at first half-way through the holes, and then further out, till they learn to get through. By such treatment this cause of death is easily avoided.

There is, however, another fruitful cause of mortality. Harz Canaries are mostly bred in a very warm atmosphere, ranging from 65° to 75° . Their lungs thus become delicate, and they come to a damper climate and an average room temperature of 60° . Some would perish of bronchitis and consumption in any case; but most people who have bought a Canary make the matter still worse by hanging the cage high up, and in a window. The window causes more or less draught and cold, alternated by burning sun; and at night the hot burnt gas of the room makes the atmosphere almost insupportable. The owner even could hardly stand it, as he will find if he puts his head for a few minutes where the cage is after the gas has been lit a while; and the poor Canary does *not* stand it, but speedily dies. Such a place also spoils the song, as these birds are accustomed to be covered up rather than in full light, except when actually singing.

The food also needs more attention than it often receives. In Germany the birds are fed chiefly upon summer rape-seed, mild qualities being carefully selected, the cocks (which alone sing) having in addition a little bread-crumb and egg. To force them on, the importers and dealers often feed them, whilst in their possession, almost entirely on egg-food; and then the bird, when purchased, is put all upon canary-seed or canary and hemp! Perhaps, besides this, it gets a lot of sugar and sweet cake, which spoil the voice (so the Germans think), though a little sugar in a damp climate might be beneficial. It is small wonder if the song rapidly deteriorates, besides which, the bird loses the stimulus of competition. This cannot be afforded unless two or more be kept; but the birds can be covered with a cloth at certain times of the day, and their diet can be managed so as to make the best of them. A very good authority advises that as soon as a German Canary is purchased a cake should be made as follows: Take one egg and beat into a froth, and in a separate vessel beat up a piece of fresh butter till it is white and soft, then add it to the egg; further, add a table-spoonful of fine flour, a tea-spoonful of crushed lump sugar, and a tea-spoonful of baking-powder. Beat all well up together, and bake in a sharp oven in a pot well greased with butter. This cake should be crumbled fine, and given mixed with maw-seed. By degrees the proportion of cake should be a little diminished, and some mild summer rape-seed added to the diet. If the bird ever seems to get hoarse in his new climate, dip a bit of stale bread in warm milk, then drop a little honey upon it, mix with enough crushed butter biscuit to form a thickish paste, and put a little at the ends of the perches.

We must next say a little about Canary breeding; but as the German Song Canary is as easily bred as any, we may just remark on the best way of going to work with them. There is no difficulty in most large towns in getting German hens of the same people as sell the cocks, many hens being palmed off as cocks by the breeders. It will be best to obtain, if possible, several cocks which have the same song; and very likely the dealer may know by the private marks on the cages that they are from the same breeder, and trained alike. If so, by all means try to secure a hen or two with the same cage-marks, in order to get hold of one strain. The cocks whose song is good are then bred from, reserving one very good one to serve as a tutor for the young ones. The young ones ought, if possible, to be trained in a room quite away from the others, and only allowed to hear the tutor-bird, as bad notes are picked up as easily as good ones. The tutors are only allowed to sing for, say, an hour in the morning, at noon, and at night, being covered up the rest of the time, which preserves the song. The young ones are covered up in the same way, accustoming them *gradually* to be

thus darkened as soon as they are caged off singly, and then uncovered for a short time at first while the tutor is singing. It is impossible to get a really fine song in any other way, the whole secret consisting in not allowing

the birds time to pick up rubbish. Birds which do pick up bad notes—as some will—should be drafted out before they can do mischief. By allowing a nightingale or other bird to be the only tutor, its song will be acquired; but the trained song is far superior to most ears. Where there is no feathered tutor, a flageolet will do, provided—and this condition is the sole condition of success—that the same air be played

Fig. 43.—THE LONDON CAGE.

always exactly in the same way. The young birds will be at first fed as described farther on, but should be gradually weaned off to the summer rape, with a little egg-food once or twice a week.

To come to our Canary breeding, however. A breeding-cage must be much larger than a song-cage, of course. There is a well-known pattern, known as the "London Cage," sold at most good shops, like the annexed cut (Fig. 43). It should be about three feet long, a foot from back to front, and eighteen inches in height. Nine inches of length are partitioned off, and divided again into two storeys by a shelf. The lower storey is a nursery cage for young ones; and the top one divided again into nest-boxes by a partition, each having access to the larger part of the cage, and this arrangement is the "London" pattern, by which the cage is known. Other cages are made larger, with nests at each end, and in other ways, but this cage is as good as any for a beginning; or a plain cage the same size may be divided into two by a partition in the middle, the nest, presently described, being hung at the back, between the two perches. The doors, with the nest-boxes and the separate seed and water holes to the nursery end, will be noticed; and if the perches be, as they sometimes are, about the size of a lead-pencil, they should be replaced by flattish, not too smooth ones, of at least double the size. The cages should be supplied with outside separate seed-hoppers (Fig. 44), not inside seed-drawers; and the best water-vessels are the conical glass ones (Fig. 45), with a little trough like the ordinary poultry-fountain. The common water-vessel used in so many song-cages is very apt to get displaced a bit, and if its hole is not opposite the wired hole the poor birds may perish of thirst. Both these are shown (Figs. 44, 45), and we prefer to describe none but the best.

The nests often sold at the shops are of basket-work, but these are objectionable, as harbouring the canary-mite, a plague so constant that care should unceasingly be taken to avoid him. The nuisance begins with a floury dust, which is, however, found to be alive; and soon the insects become larger, and reddish in colour. They harbour in the very smallest crack, between the end of a perch and the back of the cage being a common place, or even behind a loose flake of whitewash. To begin with, every cage should be thoroughly plastered out with

Fig. 44.—SEED-HOPPER.

whitewash and carbolic acid at the beginning and end of each breeding season, taking particular care to plaster up and fill every crack and chink, and leave all smooth. When any of the "fleur" shows itself, if taken in time, it will be enough to withdraw the perch (supposing it is there), paint the place with oil, and put in a new perch with an oiled end. If in a crack, paint over with spirit varnish. If it is a bad case, paint with solution of bi-chloride of mercury (poison) well into all the places, and when dried on varnish over. In this way the enemy may be conquered.

If basket-nests are used at all, they should be soaked in paraffin or petroleum oil first; but it is far better to use perforated zinc or earthenware, one or other of which is sold at most good shops. They vary from three to four inches across, and are usually made with a strip at the back, and a hole to hang on a nail in the side or back of the compartment, as in the figure (Fig. 48). But if the London cage has a hole for the nest in the floor, like that in a wash-stand, the top of a flour-dredger will make a very good nest, if made to fit the hole or the hole adapted to it. These earthen or metal nests need first lining with saddler's felt, split in two, cutting a circular piece much larger than the nest, then cutting out a deep notch with the angle at the circle's centre, and finally working the felt into the shape of the cup of the nest. This is the handiest, cleanest, and best way of nesting Canaries.

Fig. 45.—CONICAL FOUNTAIN.

The cock and hen may be placed together in the cage about the end of March or beginning of April, depending on the prospect of a cool or warm season. Now and then they may refuse obstinately to make friends, but it is very seldom; as a rule, before long the cock will be seen to feed his hen, by which it may be known all is amicably arranged, and only when one bird persistently scalps another is it necessary to try another mate. As soon as the pair are put together they should be given a mixture of "chopped" egg, as it is called, with bread-crumbs or pounded biscuit, and a little crushed hemp-seed mixed with it; also some green food, such as chickweed, groundsel, cresses, or lettuce. The egg food is usually given in a small square tin or earthenware vessel, hung on outside the cage; and the egg is best prepared by making a sieve of perforated zinc, say, six inches square, tacked on a wooden box without top or bottom, a few inches deep; through this the hard-boiled egg is forced by the flat of a knife. Canary-seed will be in the hopper as usual.

Fig. 48.—TIN FRAME FOR NEST.

On this food the hen will soon get restless, and begin tugging at the felt in the nest-pan. She must now be supplied with a little dried moss and short hair (sold for the purpose), hung in a little net outside, or even a few loose small feathers about the cage will do for a day or two, till she seems in earnest, when all old soiled stuff thrown on the bottom (which is never used) must be removed, and a fair supply given. The nest will soon be finished, and generally after a

day or two the first egg will be found there. In some cases the hen has great difficulty in laying, and appears as if about to die. Even then it is generally best to leave things to nature for at least the first night; if she has not laid then, after being ill the night before, she may often be relieved by holding her with the vent over a jug of boiling water, and then dropping on it a drop of sweet oil, afterwards putting her on her nest again. If this fails to give relief, we know of nothing that will. Quiet is very essential, and Canaries never breed well in a noisy room, where they are frightened.

The eggs should be quietly removed as laid, and placed in bran until three are stored, and the evening the third is laid all should be replaced. The hen will sit closely now, and as the cage must not be disturbed, it should have a good scrape out and be well sprinkled with coarse sand. This coarse sand is very important in all canary-breeding, as they need it for digestion, and earthy stuff clogs the feet badly. During incubation continue food as before, with plenty of green food. If the hen is very wild and fidgety, it is well to put a paper screen in front of the cage or draw a paper over it, but many are quiet. Hatching should come off on the thirteenth or fourteenth day. After five or six days the "full" eggs can be distinguished by their partial opacity, as in those of pigeons and fowls.

Just before hatching the egg-tin should be cleaned and re-filled, with more egg-yolk in proportion than usual. In the majority of cases all will go well, and the egg-tin will want replenishing two or three times a day, while the quantity of green food, which must be supplied *fresh* in unlimited quantities in canary-breeding, will be astonishing. Some hens are bad feeders, and in such cases a slight change of food sometimes helps, making the food at first of egg and crushed hemp-seed alone, which sometimes does well. Other people abhor hemp-seed like the plague; the fact is, there is much difference in likings and constitution. A great deal may be done when the hen feeds badly by cutting a hard-boiled egg in two, mixing up the yolk in the middle with saliva and the end of a flat stick into a creamy paste, and feeding the young from the end; but after all some hens either can't or won't bring up young, and there is nothing but to bear it, some such losses and disappointments being the lot of all. In the majority of cases things will go fairly well, and it will only be necessary to gradually rather diminish the egg in the food, and add a sprinkle of maw or summer rape-seed or canary-seed crushed.

During incubation and rearing the bath should be allowed on all but very cold days. Any form will do that will hang on the cage-door. Before the young can possibly fly it is also well to search for insects, and if any are found, to change the whole nest for a clean one, which must now be left, as if they are startled when rather stronger, before they are strong *enough*, and fall out, it is impossible to keep them quiet after. When any begin to *get* out it is best to turn them all out, as they keep each other in countenance, and are more likely to stay in the nest another night or two. This ought to be somewhere about three weeks old. Often the hen will want to lay again ere this, and a second nest should be placed near the other for her and material supplied, or she may pluck the young ones of feathers to line it. If this once begins, they must be removed to a nursery-cage, which is a cage of open wire hung on to the open door of the other, and with a low perch just so far off that the cock can reach to feed them through the bars, which must be wide enough for his head to pass easily. The nursery division of the London cage answers the same purpose. The cock will feed them in this way readily, and they will keep each other warm at night. If the hen behaves herself, however, they are best left in the parent cage till they gradually learn to help themselves; and as soon as they are seen to be feeding themselves altogether they should be caged off. A mixture of seeds *ground* coarsely in a coffee-mill and

thrown on the bottom helps them to learn eating seed. As long as they cry for food they must always be in reach of the cock, either in a hang-on nursery, the lower nursery compartment of the London cage, or the parent cage; but the sooner they can be caged off the better, and they are then gradually used to more and more seed and less and less egg-food, till at last they only have a little of the latter occasionally sprinkled on the flight-cage floor. Canary seed is sometimes dear; but millet (in the ear), maw-seed, summer-rape, and a little hemp-seed, &c., are all good food.

Canaries begin to moult generally some time in July or very early in August, and all breeding arrangements must then be broken up. A second thorough cleansing should take place before the moulting season. A few grains of saffron in the water help the process; and if the head, the last to moult, seems unable to start, it is best to pluck a good portion of the feathers, which often sets the stagnant blood into activity again.

VARIETIES OF CANARIES.

Besides the Song Canary, already described, which is a distinct race, there are numerous other distinct races, which may be roughly classed into *colour* birds, *plumage* birds, *shape* birds, and *position* birds, though the last two run rather together. It would be foreign to our purpose to go minutely into these varieties, but a general idea of them will be of use and interest.

At the head of the colour division stands the Norwich Canary, largely bred in the city of that name. For generations the aim of Norwich fanciers has been to get their birds of as rich, bright, and dark a yellow as possible, that is, tending to orange; and careful selection and mating and special food, such as marigolds, saffron, and small quantities of cayenne pepper, did wonders in enriching the colour. About 1872, however, a new discovery was made; it was found that *large* quantities of cayenne—a whole tea-spoonful heaped up, mixed with one hard-boiled egg, and about the bulk of the egg in crushed biscuit—made it redder still. Much was very foolishly said as to the “cruelty” of this; but the simple fact is the birds are very fond of it, and do not suffer in the least. Many other foreign birds devour capsicum pods greedily and freely, and it is probable enough that the gorgeous colours of many tropical birds are greatly owing to this cause. However, the chief objection to this feeding is that it is very expensive, and it is only worth while giving it to first-class stock meant to be exhibited. We need only say here that the young must be put on the cayenne diet, if at all, when seven or eight weeks old, and given very little else, except some green meat; while the old birds must be put on it as soon as ever they begin to moult. Under this treatment they become a very rich deep orange, more *red* than yellow; and we thus have an originally green bird changed first into a yellow, and then into a ruddy one.

There are two varieties of colour in the Norwich and many other Canaries, called by some *jonque* and *mealy*, by others *yellow* and *buff*; yellow and mealy are more expressive. The yellow or jonque shows the colour as rich, deep, and pure as possible; the “buff” or mealy should show a ground tint of the same, but with a beautiful white frost, meal, or silver over it. Even greens show this division, the mealy or buff greens looking whitish or dead against the “yellow” greens. Well, in breeding Norwich birds a yellow is generally paired with a mealy. The reason of this is that yellow birds are apt to be thin, and mealies thick in plumage, so that two thickly-feathered yellows may sometimes be bred together, or two thinly-feathered mealies. The mealy, however, needs the yellow to keep its colour rich, and even the yellows want refreshing now and then by “a dip into the greens,” the original green being apparently the

fountain of the rich yellow.' By these "greens" is not meant a common green bird; but besides the clear Norwich there are other varieties in which some green remains on the wings, tail, round the eyes, or in small ticks on the body. These are bred and shown as "marked" (if certain standard markings equal on each side), ticked, or variegated, breeding "evenly-marked" Norwich being a separate branch, and requiring great care and skill; and these birds sometimes breed one with only a few light ticks. These are what are useful for crossing with clear birds to refresh the rich colour.

Still farther, there are the *Crested Norwich Canaries*, with a large cap or top-knot on the head, which must be even and circular. These are both "clear" and variegated, and are correspondingly difficult to breed. The Norwich Canary is a compact, moderate-sized bird, remarkably close and silky in its plumage (which is called "quality"), and hardy, but rather harsh and loud in its song.

Before dismissing the Norwich section and cayenne feeding, we may add that in 1880 a new so-called "cayenne" was introduced, prepared from quite another botanical family, with the same rich colour, but absolutely devoid of heat. The birds are found to colour on it as well as on the other, so that those who shrink from the other as cruel need no longer scruple on that account.

The *Cinnamon Canary* is much like its name, and was once called a "dun." The yellow seems toned down to a brownish tinge, but is still rich, though quiet, and this variety takes colour from cayenne as freely as the Norwich does. It is a very peculiar race, however, having the peculiarity of pink eyes, which crops up continually, though absent in many birds, owing to crosses; for the bird is constantly crossed with Norwich to give colour, and often with Yorkshires. And the thing to bear in mind is this: A Norwich cock, pure-bred, with Cinnamon hens will never breed Cinnamons, and the pink eye will be absent, the offspring being almost always green; but these birds again, crossed with Cinnamons, or even with clear Norwich, breed pink-eyed Cinnamons. A Cinnamon cock with Norwich hens also breeds many Cinnamons, which are all hens, the rest being green birds. But all these Cinnamon-bred birds are valuable to breed Cinnamons. Cinnamons are bred variegated, and are beginning to be bred crested as well as clear.

The *Lizard Canary* (Fig. 47) is a magnificent bird, the head of the plumage division. It is either gold or silver, and has a clear cap of either colour, beautiful dark spectacles or eye-marks, and the back and sides splendidly marked like the scales on some small green lizards—hence the name. There is also a beautiful greenish colour, which is classed, however, with the golds, and is only common in Lancashire. The shape is chubby, like the Norwich and Cinnamons.

Fig. 47.—LIZARD CANARY.

Gold is usually paired with silver; but the strain must be most carefully bred, or all the beautiful spangling is lost. There is another point: the beautiful plumage only lasts one season. It is dimly discernible in the nest-feathers, and after the first year it more or less fades away. This is also the case with the *London Fancy*, evidently allied to the Lizard, which is dark in its nest-feathers, next moults into its perfect plumage of dark wings and tail, and clear all else beside, and finally goes off into more or less grizzle. Both varieties colour well on cayenne. The London Fancy is confined to very few breeders, and is, in consequence, nearly extinct.

Among other birds of shape we class *Yorkshires* and *Lancashire Coppies* (Fig. 48). Yorkshires are, in comparison to the preceding, very long, straight, and slim.

and stand rather upright. The clear birds are both yellow and mealy, but are not rich in colour like the Norwich, and cayenne takes little effect on them. There are also "marked" birds, with even wings and eye-marks, and these marks are more accurate in Yorkshires than in any other variety. Probably allied to Yorkshires are Green Canaries: certainly they are the same general make; but the peculiar bright green all over is a race by itself, and must be kept pure. The *Coppy*, or crested bird, is also very tall, but thick as well; he is the giant of the family, and half as big again as any other. The name is taken from the "crest," and there is no doubt this is the original crested bird, and that Norwich and Cinnamon got their crests from him. There is, however, the "Plainhead," bred from the same race without crest, in nearly equal numbers; and in breeding it is usually necessary to put Coppy and Plainhead together, or else faults occur in crest.

At the head of the "position" birds is the *Belgian* (Fig. 49), a very ugly bird to most eyes, while others see in him the perfection of breeding and training. He stands up when excited—which is done by gently scratching under the bottom of his high-domed cage—with legs and body almost upright to the shoulders, and tail straight down, with the head and neck stretched out rather below the horizontal, showing up the corners of his shoulders. Nothing more peculiar can be imagined. This bird is a little delicate, and in breeding, all depends on the strain and training every generation. In Belgium there are numerous amateur societies for cultivating this bird, under the direct sanction of the civic authorities of the principal towns, and competitions take place annually.

Fig. 49.—BELGIAN CANARY.

Finally, we have the equally characteristic *Scotch Fancy* Canary (Fig. 50), cultivated almost solely in Scotland with enthusiasm equal to the Belgian in Belgium.

It is probably descended from the Belgian, crossed with the slim Yorkshire originally, but has not been crossed now for many generations. Colour and feather are little thought of—"model" and "action" are the points. The bird stands in a curved form, like the new moon, with straight limbs, and the snaky neck and tail curved round the perch, as it were, free from any angle: that is "model." The cage is oblong and large—there must be a regular "Scotch Fancy" cage—and is furnished with two perches on the same level. It is held in the hands, and at a signal with the thumb or hand the bird hops from one perch to the other without fluttering its wings, and turning round as it hops so as to face the other way; it repeats this as often as required. That is "action," and the perfect neatness with which the change from perch to perch and the turn round are made, is the chief point,

Fig. 50.—SCOTCH FANCY CANARY.

We trust we have made it clear that there is abundance of variety in Canary breeding. None of the varieties come near the German Canary in song; but the Norwich is, on the average, the finest songster. Besides the Canaries pure, mule birds are often bred between the Canary and other Finches, especially the Goldfinch and Linnet; Bullfinch mules are far less valuable.

Colds may be treated in Canaries by putting twenty drops of paregoric, a bit of gum-arabic the size of a pea, and half a tea-spoonful of glycerine in the drinking water. Loss of voice may generally be treated in the same way, and in either case it is well to give first one or two drops of castor-oil from the point of a penholder. Diarrhoea is usually caused by a dirty cage or stale green food, and is best treated by oil given as above, afterwards adding gum to the fountain, and slightly sprinkling the egg-food with prepared chalk. Constipation rarely occurs when green food is properly given; if it does, it may usually be cured by a tea-spoonful of glycerine and another of infusion of gentian added to the drink. Do not forget to look after the feet from time to time, removing any balls that may cling to them, and which may cause much pain, and, if necessary, shortening the claws a little now and then with a pair of scissors.

BRITISH BIRDS.

WITH some exceptions, British birds are not so well adapted for confinement as the Canary. Bred in confinement for many years, the Canary is *happy* in a cage, whilst most British birds have been caught wild, and generally seem to feel that they are prisoners. They require also much more varied food and greater care to keep them in health, the great mortality being, perhaps, chiefly owing to a too general sameness of diet. Few British birds are *altogether* either insect or seed eaters.

A very valuable constituent in bird food generally is

GERMAN PASTE.

This is made according to many slightly different recipes, but the following is one of the best. Take three-quarters of a pound of pea-meal and a quarter of a pound of coarse Scotch oatmeal, and rub it up with one ounce of moist sugar. Well mix together two ounces of honey and one ounce of olive-oil; stir this into the sugared meal till all lumps have disappeared. Then add half a pint of crushed hemp-seed and a gill of maw-seed. This paste, or one like it, can be bought at most bird-shops, and will keep for a week after making. Scarcely anything is so useful for feeding a variety of birds.

The *Nightingale* is best caught early after arrival—when it has been some weeks in England it often pines away if caged—or young ones may be reared from the nest when about ten days old. At that age they may be kept for a week or so in a basket, afterwards in a cage with perches, but plenty of hay. Their legs are very fragile and liable to cramp, for which reason they must be handled most tenderly and with warm hands. They are best reared on scraped raw beef, hard-boiled yolk of egg, and a little crushed hemp and maw-seed mixed with a little water, giving pretty often some ants' eggs, or some meal-worms and beetles, cut up small. Meal-worms (another requisite in bird-keeping) are propagated thus: Fill a half-gallon jar with bran or oatmeal, putting in the bran some pieces of coarse, thick sugar-paper, such as grocers use for moist sugar. Add a handful of meal-worms, which you will get from a shop

or some friend, and keep them for a few months, now and then sprinkling them with some beer. By three months at farthest some will have attained the perfect stage of beetles, and after that they will propagate freely, and keep the jar well supplied if a little meal be added occasionally.

When old birds are caught they have to be "meated off" from purely insect diet, which is done as follows:—Scrape raw beef or bullock's heart, and make with the scrapings and some hard-boiled yolk a soft paste, adding for a few days some beetles or meal-worms chopped up. Put the mixture in the feeding-pan, and in the centre an inverted deep watch-glass, confining three or four lively meal-worms. The glass is smeared over with a little of the paste. The Nightingale pecks at the worms, but cannot reach them, and by degrees tastes the beef and egg, which, being agreeable to his palate, tempts him more and more, till in a few days he will eat freely out of the pan. In a day or two he should be crammed with a little of the mixture three times a day—not much, but enough to keep him from starving. When fairly meated off, the food should be varied a little, some individuals having fancies. Among the advisable components are scraped beef or heart, yolk of egg chopped, German paste, bread-crumbs, and some meal-worms, gentles, or beetles. In summer more insect food should be given, or some boiled bullock's heart dried and grated small, or finely-chopped cooked meat. A little scraped turnip assists digestion, and if the bird ails, a few spiders, more ants' eggs, or a little saffron have been found of use; also a fig chopped very small and mixed in the food.

The cage for a Nightingale should be made of thick wicker, with wooden back and top, and large. A proper size is eighteen inches wide, eight deep, and fifteen high, with a bow window to hold the water, and a well-sanded tray at the bottom. There should be a perch at both the food and water vessels, and these should be covered, and the top lined with green flannel and the cage painted green. The bird is thus kept more private, and in the colour nearest nature, but the paint must be thoroughly dry and stale before the cage is used. With such precautions Nightingales have, though rarely, bred in captivity. A bath should be given occasionally.

Fig. 51.—THRUSH.

The *Black-cap* is treated like the Nightingale, but adding plenty of fresh fruit of almost any sort in the season; for winter, dried elderberries or grocers' currants soaked a little in water, or a split fig, will supply this want. This bird also requires more constant bathing. The *White-throat* and *Garden Warbler* are treated like the *Black-cap*; while the *Robin*, *Redstart*, and *Hedge Sparrow*, or *Accentor*, like the Nightingale, need fruit less, though they will eat it. But in all cases variety is the great thing. Most of the Warblers may be similarly treated.

The *Thrush* (Fig. 51) requires a large cage—eighteen inches high and wide, and twelve inches deep, is none too large, and it is best made with wooden bars an inch apart, and solid back and top. There must be plenty of water for bathing as well as drink, but the cage must be kept dry and well sanded. The natural diet consists largely of insects and snails, with fruit and berries in summer; in confinement the staple food is what is generally called fig-dust, really, finely-ground oats, mixed into a stiff dough with half milk and half water, but every

other day adding a pinch of soaked dry currants or some finely-shredded raw beef. A little bread-sop may be also given, and now and then a snail, but the latter will be useless unless a stone is put in the cage with it for the bird to break the shell upon. A little yolk of egg and crushed hemp-seed may also be given. If the bird ails, a few spiders or a change of food are the best remedies. The Missel-thrush, Field-fare, and similar birds are fed and treated like the Thrush.

The *Blackbird* (Fig. 52) wants a large wicker cage, and may be fed much like the Thrush, but giving him, as opportunity offers, garden worms, caterpillars, and fruit; also plenty of coarse gravel and water to bathe. The bird, however, is often left at large, becoming very tame; and if so he will forage a deal for himself. He is a great imitator, and with patience can readily be taught a short tune from a flute or flageolet. The general method of teaching—and it applies more or less to all cases of teaching birds any particular song—

Fig. 52.—BLACKBIRD.

is as follows.—Let the bird be fed *moderately* before the lesson, then show him some especial delicacy, such as a nice worm in the case of a Blackbird (we are supposing the bird's tameness and intelligence well developed, without which little can be done). Then play over several times a few bars of the tune, in precisely the same way each time. He will soon pay attention, and when you have played a score of times wait a little, to see if he makes any attempt. If he does—though it be but one note—give him his worm *instantly*, and pet and caress him. He will soon discover how these pleasant things are earned, and be hereafter an apt pupil. A young Blackbird may be brought up near any good songster, and has been known to catch the crowing of a cock. The cage should be placed out in the sun, except in hot dry weather, when it should be well shaded with fresh damp leaves.

The *Lark* (Fig. 53) requires a cage with a bow window, in which a turf can be placed so as not to be fouled by the droppings. It needs no perches, but must have plenty of road dust or gravel, and a fresh moist turf daily. If young ones are reared, they want feeding from four o'clock in the morning, and may be given soaked bread mixed with crushed hemp-seed, and a little scraped beef and egg. The adult birds are fed much the same, with a little German paste, and an occasional meal-worm in addition. The Woodlark and other larks and pipits, are fed much the same; in fact, almost the whole range of food

Fig. 53.—LARK.

given for the Nightingale may be occasionally given with very great benefit. The Finches, a large family, are chiefly seed-eating birds. The *Goldfinch* is nearly as adapted for cage-life, and as happy in it, as the Canary, and will readily breed. The management will be very similar, and the whole range of bird-seed will be suitable food, but some birds will scarcely touch certain seeds, and only

a little hemp-seed should be allowed. The *Bullfinch* (Fig. 54) is another tame and hardy bird, easily reared. The young are best fed on a simple diet of soaked stale crust of bread mixed with scalded rape-seed and chopped egg, weaning them off gradually to a miscellaneous seed diet. This bird is remarkable for sometimes turning black. The Bullfinch is another bird of strong imitative faculties, and is accordingly often taught to pipe a tune. There are regular trainers of these "piping Bullfinches" in Germany, and some are worth £3 to £5 each; perseverance with a flageolet or a good whistle, in the manner recommended for the Blackbird, will usually succeed. The Chaffinch, Green Finch, Linnet, Siskin, Red-poll, and other finches, may all be reared and fed as the Goldfinch and Bullfinch, giving the birds the choice to some extent of their own favourite seeds, but limiting hemp-seed always. Always give a variety; add now and then a little German paste as a delicacy; give occasionally a meal-worm or two or other insect food to such as will take them; and always give to all groundsel, chickweed, or similar green food; of groundsel all the finches are very fond. With this treatment, plenty of gravel or road-dust on the bottom of the cage, and bathing, almost any British Finch will keep in health.

It may be worth mentioning that the common *House Sparrow*, caught young, easily becomes extremely tame and makes a capital pet. It only requires seed and vegetable diet.

The *Titmice* are very pretty birds, amusing and quaint in their habits. A lot are best kept in a large cage, with bough perches and some holes in virgin cork, when they will be always flitting about. The food for the young will be the same as for young Nightingales; the old birds are fed on German paste, soaked bread and hemp, whole hemp and oats, with a good allowance of almost any animal food, such as scraped beef, eggs, meal-worms, flies, and any insects; they also enjoy picking a bone, and nuts occasionally with the shell off. They get very tame, and will eat from the hand.

Fig. 54.—BULLFINCH.

The *Woodpecker* is a fine bird, and easily kept if caught young. It does not perch, but must have some virgin cork or the rough bark of trees nailed on the sides of a rather large cage. They are pugnacious, and therefore must be kept singly from a fortnight old, feeding on scraped beef and egg, soaked bread and hemp-seed, ants' eggs, meal-worms, beetles, &c. It is very tamable if caught young. The *Nuthatch* requires similar accommodation; but its food consists of nuts, shelled and unshelled, beech-mast, berries, seeds, German paste, bread, and hemp, with a little scraped beef and egg. Generally speaking, the animal food predominates in the Woodpecker's diet, the vegetable in that of the Nuthatch. Both are very amusing birds.

The *Jackdaw*, *Raven*, *Jay*, and *Magpie* are a group of birds much alike in character and habits: very tame, but all somewhat mischievous and pilfering in disposition. The Raven, especially if kept in a cage, requires a bone to occupy it, or else it will be ever destroying its cage; and if left at liberty small articles will be stolen. The diet of all consists of table scraps, ground oats mixed with stiff paste, and bits of meat, raw and cooked; mice are also much relished. Nearly all will talk more or less if trained, and except for their

thieving propensities make very nice and companionable pets. The cages must, of course, be very large. The *Starling* may also be taught to talk and whistle very fairly; but its food and treatment more resemble those of the Thrush, adding fruit and garden worms.

Hawks and *Owls*, of any sort, require raw animal food almost entirely, such as pieces of raw beef or mutton, chickens' heads, giblets, mice, and birds; also rats for the larger. Some of them will not keep in health unless given a fresh mouse or bird several times a week. There is little to recommend these birds, and their diet makes the cages very offensive unless great care is taken to clean them frequently, and supply plenty of gravel and sawdust to absorb the smell.

Many other British birds can be kept in confinement, but are less common, and space will not allow us to enumerate them all. In all cases the natural diet should be ascertained, and the birds fed accordingly. Spring, which is a critical time with all, may often be tided safely over by adding a few fresh buds of some tree to the usual diet.

Doves are best kept in an aviary, and treated as pigeons, which they resemble in habits, but giving them more small grain, such as millet and dari. They will readily breed in this way, raising several pairs each year. The turtle-dove, often erroneously called the "ring-dove," from the black collar round its neck, will often breed in a large cage if there is a separate nest-box where it can be a little retired from full view.

FOREIGN BIRDS.

AN endless variety of most beautiful foreign birds is now at the command of the fancier, and we must be content to mention them in a few of the main classes into which they can be divided, and which will very much determine the proper feeding appropriate to each.

At the head stands the parrot, of course, in many varieties, the most popular, however, being still the Grey Parrot (Fig. 55) so well known to everybody. They are imported now in larger numbers than formerly, but unfortunately the majority die, and it is better and cheaper to buy an old acclimatised bird at a good price than a young fresh-caught bird cheap. These young ones are known by their grey eyes, the old ones being straw-coloured. It seems strange that although these Parrots are so tame, and even unmated hens often lay eggs, no one seems to breed them, which, probably, might easily be done in an aviary or very large cage, with a hollowed log of wood to serve as a nest. If any attempts of the sort are made, it is well to remember that the nests of *all* the Parrot tribe are in such

Fig. 55.—GREY PARROT.

hollow logs, with a hole in the side for entrance. The food of Grey Parrots should consist of maize, oats, wheat, and bird-seeds, with occasional nuts and

biscuits of various kinds, and ripe fruit as opportunity offers, this last being very useful and wholesome. They will readily learn to eat potato, and may have bread and milk and such things pretty freely; but although they will eat meat pretty readily, it should not be given, tending to produce disease. They should be allowed to bathe often, and if they do not do so, in summer should be gently showered every now and then with warm water from a syringe.

The *Amazon Parrot* is a more highly-coloured bird, usually green over the greater part of its body. It is as good a talker as the Grey, and should be treated just in the same way.

The *King Parrot*, a splendid green and red bird, *Pennant's Parrakeet*, and the *Rosellas*, are the best known of the other large Parrots; and all must have the same general diet of seeds and vegetable food, with some fruit in the season. Such as come from India generally do best if they can have at first some rice in the husk, gradually adding other grains and seeds. If it is wished to attempt breeding, and the two birds (known to be a pair) will not agree, which is often the case, it has several times been found an effectual remedy to smear the hen with oil of aniseed, which seems a strong attraction to most of the tribe. One of the quietest varieties, and easiest to breed, is the beautiful *King Parrot*, about which there is little difficulty if a fair-sized aviary can be given up to a pair, with no other companions except a few other pairs of quiet birds. Many of the noisy kinds of small Parrakeets would make the case hopeless. A pair of *King Parrots*, *Cockatiels*, *Rose Cockatoos*, and small sulphur-crested *Cockatoos*, have been named as a good selection for breeding together.

Fig. 56.—COCKATOO.

Parrots usually leave off screaming much as soon as they get tame and familiar; but there are exceptions, and the noise when several *Cockatoos* are kept together is apt to be deafening. Cages must be provided of the strongest character, or they will rapidly be destroyed; and until the birds are tame the immense power of their beaks must never be forgotten. One of the larger Parrots or *Cockatoos* would break or cut a finger in two with perfect ease, and a bad-tempered bird should always be approached with some caution. If such an one must be taken hold of, the only safe way is to take a firm grasp round the neck. It is advisable only to keep one bird by itself, unless an attempt is made to breed. Generally speaking, the staple food of all the Parrots should consist of grain and seeds, especially giving millet, Indian corn, or our harvest grains in the ear, or on the stalk when possible. Hemp-seed must be given very sparingly, especially in summer, being too oily and heating; sunflower-seed is not so dangerous, and equally relished. Such green food as salad herbs, chickweed, groundsel, &c., fresh but not wet, should be given freely; and a shoot of elder, willow, ash, or even a common stick, will afford pleasant occupation in gnawing. Meat or chicken-bones are simply hurtful; but sponge-cake and biscuits are good

in moderation, and so are various nuts, or ripe fruit, not sour. Pieces of cuttle-fish help greatly to keep the birds in health, affording them occupation, and the salts being apparently beneficial.

Cockatoos (Fig. 56) require the same general treatment as Parrots, with the sole exception that any which have newly arrived from the Moluccas or New Guinea require at first boiled rice and maize, till gradually weaned on to dry grain. Cockatoos are the worst screamers of the tribe, and the most jealous and revengeful, though also capable of strong attachment. They are usually far more quiet if a male and female can be paired.

Next comes a large family of smaller Parrakeets and so-called Love-birds (Fig. 59)—all of the most beautiful description. At the very head for beauty, hardiness, and docility stands the magnificently-marked Budgerigar, or Undulated Grass Parrakeet, or Shell Parrot of Australia. Sold at £20 per pair so late as 1850, these exquisite birds can now be

Fig. 57.—TREE-NEST FOR PARRAKEET.

bought at from half-a-crown to a sovereign per pair, depending on the number imported in any particular season; and the bird has the further merit of breeding in captivity as readily as a Canary, under proper conditions. It does best if forty or fifty pairs can be loose in a room, being very gregarious. In that case a few tree-perches and shelves should be fitted, and on the shelves should be placed nests formed of logs, turned hollow nearly to the bottom, so as to leave a deep hollow about three inches in diameter, with a rather cup-shaped bottom. A piece of bark covers this on the top, and a hole an inch and a half in diameter in the side gives access (Fig. 57). No lining is required, but a very few cocoa-nut fibres may be placed in the bottom. Others prefer a cocoa-nut husk fastened together with wire, and a hole cut in the end (Fig. 58). As to food, all that is required is canary and millet-seed and water; but caution must be exercised in giving the latter to newly-imported birds, as they are often brought over without a drop the whole of the voyage. They seem to do pretty well on this dry regimen, and some breeders keep them successfully without it after arrival, but as they drink eagerly if allowed, it would seem better to afford it; while, on the other hand, caution is obvious till the first craving has thoroughly passed off. The young hatch in about three weeks, and the parents will bring them up on seed. They are grey in their nest-feathers. As they mature the males are known by their blue noses, the females being brownish in the same part. Odd adult birds should be disposed of.

Fig. 58.—COCOANUT HUSK NEST.

Single pairs will breed in a large cage furnished with a similar nest, but are apt to get too fat. After confinement awhile, it is a good plan to let them have the liberty of a sitting-room, where they make little trouble and scarcely any mess. They retain at first their Australian breeding season (where the summer corresponds to the British winter), and accordingly begin to breed in December or January, in consequence of which the hens are very apt to be egg-bound with the first brood. This can generally be relieved by a few drops of castor oil internally and a drop of sweet-oil on the vent.

We have already noticed the fact that under domestication these beautiful green birds have bred many yellow specimens; in Germany a blue pair has been bred, and some very large ones. The original colour fades considerably in home-bred specimens, and continual crossing with imported cocks is needful to keep up their beauty and prevent the evils of in-breeding. We have often thought that some capsicums might perhaps aid in preserving intensity of colour.

The *Turquoise* Parrakeet is another variety very easily bred on the same diet as the *Budgerigar* when once acclimatised, but many arrive in poor health, and are delicate till recuperated. *Bourke's* Parrakeet (*Cockatiel*), a rather plain-looking variety, and the *Blood-rumped* kind, also breed freely, and the last has a very good song. Most other Parrakeets will do with more variety of any dry plain grain, and may have their choice, at least, of chickweed and groundsel.

The *Many-coloured* and *Beautiful* Parrakeets—truly beautiful as they are—are delicate. There is some reason to think that the latter variety requires animal food, such as ants' eggs, in addition to grain. We cannot even mention the many other beautiful varieties of Parrakeets and Love-birds. We need only say that the true or *Red-headed* Love-bird, should be fed on millet, Indian corn, canary-seed, oats, and such-like. They have never yet been bred in England.

Lories are difficult to keep in health, except the *Blue Mountain* Lory. This bird requires, besides canary-seed and Indian corn, &c., a little sponge-cake (which is very useful to many Parrakeets and Parrots), sweetened boiled rice, dates, figs, and fresh fruit.

There are countless other varieties of fascinating foreign birds. Very interesting are the *Weaver*-birds, including the *Oryx*, *Bishop*, &c. To breed these a very roomy cage is needed, and a supply of coarse fibre, such as Manila hemp, cocoanut, also fibre such as is sold for fireplaces, and some soft feathers and hair, the hair and fibre being in lengths not exceeding six or eight inches. The birds are to be fed in winter on canary and millet, with plenty of green food, and the male is then plain in colour. In summer he assumes his rich coat, and with the approach of this change, and while the bright colours show the breeding season continues, there should be added a moderate portion of animal food, such as meal-worms, egg, or ants' eggs, also some German paste. The males only come into colour in the second or third year, and as till then they resemble the females, the sex cannot be determined, which is the most tiresome point about the *Weavers*. They want no heat beyond that of an ordinary room.

The *Whydah*, or *Widow*-birds, are pretty hardy and easily kept, but do not readily breed. A very large cage is necessary if their summer plumes are to be kept in good order.

The army of foreign Finches is a vast one. Nearly all of them are exceedingly pretty, but they vary immensely in their price and facility of breeding in England. Fortunately, several of the most attractive are also the cheapest and easiest managed. Amongst these are the *Australian Zebra Finch* and *Diamond Sparrow*. The former, in fact, is apt to be too prolific for health, and should be

Fig. 59.—LOVE-BIRDS.

kept for awhile on millet and canary and green meat alone, without nesting material. Then a cigar-box on end, with one side half cut away at the top end, and nesting material may be supplied, with a little sponge-cake, ants' eggs soaked, and yolk of egg, in addition to their seed; they will soon lay, and rear their young (hatched the twelfth day) on the same food, with soaked millet. The young are pearl-grey, with black beaks, which gradually change to red; and when full grown, the male is known by chestnut patches on his cheeks and banded sides, the female remaining dull grey on the under parts. They will breed, if allowed, at three months old. A lot of these birds may be bred in an aviary or large cage.

The Diamond Sparrow requires rather different management. The sexes should be separated in winter, two or three males (and the same with females) being put alone in a large cage, when their jealousy will keep them active without real injury. About March one pair only should be mated for each cage, as two couples will never agree. Food till now should be only canary and millet in the ear, but a few meal-worms and a little egg and German paste may now be added. Nesting material must be supplied, but a box is useless; one of the little cages in which German Canaries are sold will often be accepted and built in, or a bit of bush often succeeds. For the young liberal animal food is necessary, *fresh* ants' eggs being best; if unattainable, the best must be done with meal-worms, egg, soaked dry ants' eggs, and soaked seed. After hatching, the female will often fight the male desperately if he goes near the nest, and in such circumstances he must be caged off at once till wanted again. This and a propensity to get too fat for breeding are difficulties; and in consequence some people cannot breed this bird, while others seem to do so easily.

Amongst other Finches that may be bred with little difficulty may be named the Australian Crimson Finch and the Parson Finch. The pretty double-banded Finch will breed in an aviary, but hardly in a cage. The Avadavat, or Amaduvade (an African Finch), is perfectly hardy so far as living is concerned, and very cheap, but will not breed unless it can be kept throughout the year in a tropical temperature. The Waxbills also require the same conditions to breed, but are hardy merely as cage birds. The dealers who sell foreign Finches will always be able to give hints as to the general food and habits, whether the birds are fed solely on seeds and green meat or require animal food, &c., and these hints should be followed with observation and judgment; but whatever the food of the adults may be, to breed and rear young usually requires soaked seed, meal-worms, egg food, and such-like assistance. As a rule, the African Finches will not breed except in a hot-house temperature.

The foreign *Starlings* are magnificent birds, far surpassing the English variety in the lustre of the plumage, whence they are often called "glossy" Starlings. They are pretty hardy, and may be even bred without any great difficulty in large cages or aviaries; but will eat small birds, and play the mischief generally among a miscellaneous lot, and must therefore be kept by themselves. An aviary solely tenanted by a few pairs of these birds is, however, a magnificent sight. The food entirely differs from that of the birds hitherto described, and must consist of soft food, varied with animal matter. They may have first a little sop made from stale bread soaked a night in water, squeezed pretty dry by hand, and then mixed with one-third coarse oatmeal and a little boiled milk. An hour or two later Mr. Wiener recommends a mixture of German paste, dry bread-crumbs, ants' eggs, currants, and egg; and about mid-day a few morsels of raw beef cut very fine. This kind of food will suit all the "soft-food" birds, or most of them, the smaller ones, however, doing better with a few meal-worms than with raw meat. In the case of the Starlings this food must be varied with ripe fruit—*any* fruit, so long as it is sweet and ripe—and will also eat a little seed

now and then. They must also have plenty of water to bathe, and be kept very clean, and always supplied with a deep saucer of gravel or a large turf in which to dig their beaks, else these grow deformed. They will quickly become over-fat, and probably die of fits, if fed too freely, but by feeding in small quantities, and often covering their food with a layer of mould or gravel, so that they have to work for it, this may be avoided, and the young ones, if any, will get better fed. The nests are made in hollow logs or large cigar-boxes.

The *Orioles* are allied to the Starlings, and should be treated very similarly.

The *Cardinals* are rather "loud"-looking, largish birds, with a queer crest on the head standing up as if frightened. There are various colours, the bright crimson Virginian Nightingale belonging to the group. They are hardy, easily kept, and very easily bred. They must, however, be kept singly or in pairs only, being very tyrannical and savage to others, especially small birds; in fact, some of them have a trick of killing their own young. They are allied to the Finches, and are therefore fed chiefly on seeds, with a little of the soft mixture mentioned above and a very little animal food.

Java Sparrows, both common and white, are easily kept on canary-seed. The white variety is both most valuable and easiest to breed; in fact, a pair will breed in a cage as freely as canaries, making their nest in any suitable box or a large canary-nest. The young birds are reared on scalded millet, with a little egg food. A few speckled birds will occur, and must be discarded. Java Sparrows are amongst the tamest birds—almost stupidly tame, in fact; and as they are hardy, this is worth noting. They are, however, readily taught tricks. The young will fetch nearly twenty shillings a pair, and breeding will therefore pay if a good strong pair are procured.

Japanese Mannikins are as tame as Java Sparrows, and many of them seem actually to have almost forgotten how to fly, through having been bred for generations in very small cages by the Japanese. They will allow themselves to be handled (we speak more especially of the white or pied varieties, known as the White Bengalese) without attempting to move. They will breed freely by placing a pair in a London canary-cage, and feeding them on canary and millet and water alone till in full plumage and condition, without a nest. Egg food and ants' eggs, &c., may then be added and a nest given. The only difficulty may be that the hen will lay and lay, but not sit, owing to the Japanese habit of making them do so by bringing the young up by hand. If a hen does it, it is little use trying further—another hen must be got. But once get a good hen, and she will rear lots, giving them then soaked seed, with the insect and egg food.

The *Blue Robin*, or *Blue Nightingale*, is a handsome bird, to be fed much like a Thrush, or on the soft food and insects above described for the Starlings, minus the meat. The *Mocking Bird* may be treated in the same way, and both will lay and hatch freely, but, unless the food is given often, and in very small quantities, are so greedy as to starve their young. With these we must bring our list to an end, with the remark that we have hardly described a tithe of the beautiful creatures to be found amongst foreign cage-birds.

DOGS.

In many respects, as everybody knows, the dog is rivalled as a pet by no other animal. The difference is, perhaps, chiefly in this, that he is very much more than a pet, and is capable of becoming a real friend and companion. He can participate in some degree in his master's thoughts and feelings, as well as in his company; he can dream; and seems to have something even approaching a moral nature. At least, while other animals may show signs of knowing that they have incurred punishment, the dog often seems to betray the possession of a real conscience—to feel aware that he has *done wrong*, while he is as sensible to ridicule as to scolding or to praise. No animal comes anything like so near to man in

mental endowments, and it is this which gives to the companionship of a dog such a wonderful charm. He is, or may be, a real *friend*, and his sympathy with grief is often as real, and has before now been felt to be almost as precious, as that of a human being.

Such an animal ought to be treated accordingly, with something of respect as well as consideration. As a more rational creature, who feels any neglect in increased proportion, it is the more *due* to him to consider his health and comfort, and treat him accordingly. Yet this is not always the case; on the contrary, because he is so petted he suffers considerably from injudicious feeding, and no class of animals, up to very lately at least, was perhaps so often and wretchedly out of health as ladies' pet dogs, pampered and



Fig. 60.—MASTIFF.

surfeited till they were tortured by dyspepsia, from which a dog has been known to release himself by suicide, as more than one human being has done before him. In consequence of the publication of many excellent books upon dogs, matters are perhaps not so bad now; but many an over-fattened wretch we meet testifies to the fact that too much of such cruel kindness exists still. A few plain words will not, therefore, be amiss respecting the proper treatment of a dog.

First, as to his sleeping-place, for he should have some regular habitation, and not be obliged to shift his quarters as he best can. A corner of any dry shed will do very well, if a portable wooden bench about a foot high, and of a size proportionate to his, be placed in a back corner, and bedded with pine shavings or straw. This bench should have a board back and sides, about half a yard high, and a ledge of a few inches in front to keep in the bedding. Where the shed or stall in a stable does not offer, there must be a kennel. This also must be a fair size—which is what most people would call *too large*—for the dog; and the main part of the arrangement will be to secure that the rain and wind cannot drive in on the

animal, which as kennels are usually contrived is almost always the case. There are two ways of preventing it. One is to make the kennel with the hole at one end of the *side*; thus the rain or wind drives in sideways, while the dog is back out of the way; such a kennel is strongly recommended by the high authority of Mr. Vero Shaw, and can be placed anywhere. Or a common kennel, large enough, can be placed just the opposite to its usual position, or with its *face to the wall*, and about two feet distant from it. The sheltering wall will then act as a weather-guard. A mere barrel with one end out, placed on its side, and turned the same way, will make a very fair kennel; and in either case it is wonderful what a difference a wall so used makes to the comfort of the animal. Either kennel or barrel must be raised two or three inches clear of the ground to ensure its being dry, and white-washed with hot lime several times a year, always choosing warm, dry days.

The less a dog is chained the better. It sours his temper more or less, and makes him miserable, being contrary to all his instincts. Many dogs must, however, be chained at night, even if at liberty in the day. Never chain a dog to his kennel, which is never secure, and may produce accidents; but have a post well driven into the ground close by, and chain to that by a strong chain and ring securely fastened.

Straw or pine shavings (the yellow, turpentine sort) make the best bedding—sawdust and hay are bad. The bedding must be renewed regularly once a week, and

it may be needed oftener, depending on the dog's habits, and the weather, for it must always be dry—damp may soon cause rheumatism. The bedding must be thoroughly cleared away, regularly brushed clean out of every corner with a strong, brisk brush, and taken away to the manure heap, or burnt. In hot weather dogs are more comfortable without straw or anything else. Now and then the kennel may want a scrubbing. Small pet dogs may have beds in the house; but the same attention must be paid to the most costly bed, and the filling renewed if necessary; and, in any case, a periodical purification, and the liberal use of Persian powder, will save both the dog and his owner from annoyance. If vermin do appear, as they will after neglect of dog or kennel, besides treating the dog himself, his kennel must have a thorough scrubbing out with diluted carbolic acid.

To keep a dog in health, his coat must have regular attention, in the shape of regular grooming and an occasional wash. Dogs which are sent to public exhibitions are groomed every morning, a fact which shows the benefit of the practice; though so much as this is not necessary. At least once, and better two or three

Fig. 61.—BULLDOG.

times a week, however, a dog should be groomed. For short-coated dogs a hair-glove, sold for the purpose, is best; for long-coated dogs a comb, and the sort of hair brush called a "dandy" brush. At first the dog may want chaining up while he is groomed; but after a bit he will like the operation rather than otherwise. Rub down his legs first, and rub pretty thoroughly, but not violently; the result is to get dust and dirt out of his coat, and keep the skin in good order. The comb is only wanted in case of a tangled place, and is to be used gently, not tearing out the hair. Besides grooming, however, dogs kept in the house generally need washing about every fortnight; if kept chiefly out of doors once a month may do. Dogs never like this, and must be well held the while. They are mostly washed in a large tub of warm water, wetting them thoroughly first, then

rubbing in white curd soap to a good lather, and then washing out again. Always do the head first, as this is the most sensitive part, and you have an otherwise dry dog to manage the while. When all is over, the dog must have a *thorough drenching with cold water*, which will keep him from catching cold. After this he should be dried, as far as possible, with the sponge and a rough towel, and kept from rolling on the ground. It will of course be arranged that a dog has perfectly clean bedding the night of his wash. In winter a dog should not be washed so much,



Fig. 62.—LANDSEER NEWFOUNDLAND.

and if he is regularly groomed it will not be necessary he should. If, in spite of all, a dog does become infested with vermin, he must be treated at once, or his appearance soon becomes wretched. The kennel, and all parts of his lodging must be thoroughly scrubbed out with carbolic acid solution. If it is only fleas, they can be got rid of by covering the dog all over with oil well rubbed in, and leaving it on several hours, then washing him. Remember, as a great authority puts it, the oil must be put on "from the tip of his nose to the end of his tail," or the fleas will find refuge. Lice and ticks may require more energetic treatment. Some people use paraffin oil; but the most effective remedy is to rub in white precipitate powder, dry. As this is poison, both in the stomach and through the skin, if absorbed, the dog must be muzzled first to prevent him from licking it, carefully kept dry for an hour or two, and then the powder should be well brushed out with a dry brush. In small dogs it is often sufficient to rub Persian powder into the coat, and this is not injurious.

Some people recommend washing with yolks of eggs. It is milder and better than soap, and makes a good lather in tepid soft water, but for all but the smallest dogs is far too expensive. For these one or two yolks will do, and it is worth while for the delicate skin of a Maltese; but when it comes to a couple of

dozen eggs for a Newfoundland, few people would incur the expense, and it is really unnecessary.

As to the management of dogs in the house, we cannot do better than quote the following, word for word, from Mr. Vero Shaw; it is a mine of condensed wisdom —

“Whether a dog is an acquisition or not as a household companion very much depends upon his habits of cleanliness; for nothing can be more offensive than an indoor pet upon whose behaviour no reliance can be placed. In the case of an old dog accustomed to live outside, and who has not been taught in his youth, we fear the inculcation of cleanly habits will be a difficult matter. The whip is the only remedy which can be applied, and its application should be neither light nor meagre. With puppies the matter is usually far simpler, and they soon acquire good manners if once convinced that punishment is the certain result of dirty habits. Before the whip is resorted to, the offender should always be taken to the place where the *faux pas* occurred, and the enormity of his conduct pointed out to him in stern but not passionate tones. A sound whipping should next be immediately followed by his expulsion from the room, and on his return from out of doors no further notice need be taken of his offence against good manners. After a few repetitions of this treatment the dog will understand what he is punished for, and will gradually learn to avail himself of the opportunities provided by his periodical runs outside. Some resort to the system of spreading pepper on the place where he misbehaved, and rubbing the dog's nose in it, and this is often effective in obstinate cases, but is an unnecessary severity in teaching young dogs. The opportunities for runs outside already alluded to, it need hardly be said, must be regularly given; and it must never be forgotten that a dog cannot, like most animals, void his urine by one act, but is obliged to expel it in small portions and by many separate efforts: much suffering may be caused by forgetting this. Indoor pets should always be allowed a run the last thing at night, and several outings during the day; else they cannot be expected to be clean, and it is cruelty to punish a dog for what he cannot help. Experience has taught us one thing, which is, that one *thorough* whipping does more good and less harm to a dog than a series of minor corrections. He remembers it far longer, and in his heart knows he deserves it for something or other, even if he has not learnt what the actual offence is; but if he is always being scolded and slightly punished, his master soon appears in the light of a persecutor, and the dog becomes either permanently cowed, or perhaps turns savage, and thereby unfitted for an indoor companion.”

Fig. 63.—BLACK RETRIEVER.

In the next place we must say a few words on the feeding of dogs—by which we mean full-grown dogs, not puppies. As a rule, the difficulty with one or two dogs kept about a house as companions, if at all allowed indoors, is to keep them from getting too much. If *only* fed out of doors, of course their meals can be estimated; but if a dog is allowed in at meal-times, everybody gives him a bit of something, and it is astonishing how much it amounts to in the long run. It would be almost safe to say that a dog allowed such indulgences in the house ought never to get any other—any regular—“feeding” at all; and in most cases it would be true. It is far better for him never to be in at meal-times, but to have all his food taken out. The scraps of the house—bits of bread, vegetables, pudding, and small scraps of meat, make as good food in the long run as can be, *provided* certain conditions are observed. 1. Let there always be a fair portion of refuse or coarser parts of the *green* vegetables in the mess; which will be relished well enough with a little gravy or pot-broth on them. 2. Let the amount of meat be strictly proportioned to the average exercise of the animal. If

he leads an active life, pretty well half may be meat; if he is an indoor pet dog, only a *very little* should be allowed. This rule is inflexible and invariable, if the animal is to be kept in health and not to smell offensively; and to give small pet dogs plates of bread and butter, or cut meat, is not kindness, but cruelty. Sooner or later the animal has to go to the doctor; and what does he do? Sometimes gives a dose of physic;

Fig. 61.—SETTER.

but in most cases simply turns a crate or a tub over the poor pampered little beast, and *starves* him back to health again! As for the drink, let it be pure water and nothing else.

Where there are no scraps, or not enough, and food has to be bought, nothing is better than the “dog-biscuits” sold for the purpose. They can be broken up and soaked either in hot or cold water, and if necessary a little boiled paunch, or fresh greaves, mixed with them. They are rarely required for dogs kept merely as family pets. Oatmeal porridge is also good food. Mr. Vero Shaw strongly recommends that about once a week in summer, and every fortnight in winter, a little sulphur and magnesia—a teaspoonful of the mixed powder for a dog weighing fifty pounds—should be given rubbed up in a little milk, to keep the bowels and coat in good order.

Give as much regular exercise as ever you can. To chain a dog up *sometimes* is good, as it makes him more active when at liberty; also it is useful in subduing him to authority, as he will always show most regard for the one who most often unchains him. For this reason a purchased dog should always be first chained up, if possible, and *first released by the one who is to be his principal master or mistress*. This plan rarely fails, and a few repetitions never fail. Be very sure

your dog, whenever chained up, has shade from the sun at his choice, and cool water by him. His food should not be given oftener than twice a day, and once in the evening is just as good if regularity be observed. Bones may be given with discretion; but should either be very large, without much meat on, so that the dog can only gnaw and mumble them, or be well within the power of his jaws; otherwise he may get choked.

Training a dog to tricks, or to fetch and carry, is entirely a matter of patience. But there is one caution very much needed, and that is, never make your dog fetch or carry stones, or anything heavy by a hard metal handle. His teeth are strong, but they are not meant for this, and suffer for it. By the way, look after those teeth occasionally, and if they seem to clog up with tartar, have them seen to in time; so you may keep him healthy to a good old age. We have known a man clean his dog's teeth regularly with a brush and carbonate of soda; it was a needed attention in that case, and quite effectual.

If a bitch has pups, the best way on the whole is to leave her alone to manage matters by herself. The only thing to attend to particularly is, that if she is to occupy any other than her usual sleeping-place, it should be all got ready and the animal placed in it at least a week beforehand. She will then get used to the place, and be comfortable, whereas in a strange place she will show much distress, and sometimes get back to her old quarters at the last minute, or carry her pups there as soon as born, to the injury of all. Let her always have water within reach, and feed her rather better than ordinary. If it is a valuable animal and you want to rear all the pups, try and get a foster-mother, as the mother ought not to rear more than five or six herself, and if a large breed, four are plenty.

Fig. 65.—BLENHEIM AND KING
CHARLES SPANIELS.

From the very first day the mother should be led away from her pups, for at least a few minutes, twice a day; it will enliven and cheer her up wonderfully. Very soon she must be given regular exercise; and while suckling should have milk and plenty of vegetables.

As for the pups, they must be left to Nature's food for two or three weeks, but as soon as they can lap up milk they should be allowed to do so: it saves the mother. New milk is best, but skim milk with some sugar in it will do. Gradually you can add some

Fig. 66.—FOX-TERRIER.

cornflour, advancing to bread and milk, oatmeal porridge with milk on it, and by degrees some boiled dog-biscuit with gravy or broth on it. They should be fed more and more, and gradually weaned quite off about the sixth week.

They will want feeding several times a day—four or five when young—and two or three times a day till they are full grown. As soon as they are weaned care must be taken to give them a perfectly dry sleeping-place.

Above all remember this, the chief thing to get puppies of large breeds to be large, fine dogs, without weakness of the legs, or deformity in the joints, is plenty of regular exercise. Without this the body seems to grow too fast for the legs, which are apt to give way. It is by no means easy to rear a large dog with both strong and straight limbs.

It is no use saying much about diseases

Fig. 67.—DACHSHUNDS.

in this work. If any valued dog gets seriously ill, or shows any serious skin disease, it is safest and best to get the advice of a *qualified veterinary surgeon*, or to write, describing the symptoms, to some journal which deals with such matters, and which employs the highest skill in answering such questions. It may, however, be worth while to say a few things about *distemper*. First of all, this does not attack all young dogs, or nearly all; if you get a healthy puppy, keep him well, and if he is not infected by some other sick dog, the probability is he may never have it; there are large kennels which have known nothing of the disease for years. Secondly, the disease almost always begins as a sort of cold in the head, with running at the eyes; but can soon be distinguished from a mere cold by the patient getting thin. This emaciation, with the running at eyes and general ill-health, is the chief symptom. And lastly, in an ordinary case the best treatment is, first a small dose of castor oil—two table-spoonfuls for a very large dog down to a teaspoonful for a small one—followed by a cooling mixture of chlorate of potash. Every chemist makes up some "fever mixture" containing

Fig. 68.—SKYE TERRIER.

this drug, and will tell you the dose for the particular dog for three times a day. After a few days of this—say a week—in most cases the dog will be ready for small pills of quinine, about which also ask the chemist, and meantime it must have nourishing diet, such as a little meat, milk, the yolk of an egg or two, &c., in addition to his usual food. This treatment will bring through ordinary cases, and in severe cases you must have advice if you are to save the dog; but have good advice, and not that of a gamekeeper or “man who knows about dogs”—precious little as it generally is!

BREEDS OF DOGS.

The *Bloodhound* is a noble-looking animal, in fact the noblest in aspect of all the canine race, grandeur and calm being both blended in his aspect. The high, peaked, or conical skull, the immense pendulous ears, the deep flews, and the peculiar red “haw” or inner eye-lid at the lower corner of the eyes, are his most striking points. His power of scent is proverbial, and descent from him is probably at the bottom of all breeds noted in this respect; but it is a popular error to suppose the dog ferocious. On the contrary, most dogs are, as a rule, calm and quiet in an ordinary way. Some dogs, however, are apt to get very excited if at all provoked, and are then dangerous. This noble dog is, therefore, not so suitable as some for a general pet, apart from his usually staid demeanour.

The *Mastiff* (Fig. 60) is a far larger dog in frame than the *Bloodhound*, with a broader face and muzzle, smallish ears, and flat skull. The most popular colour is fawn, and a dog of this colour irresistibly reminds one of a lioness. The *Mastiff* is not very playful except while very young, being rather a grave and stately dog when matured; but his temper is usually perfect, and if not always a very good playfellow, he is unequalled as a guard, and may be trusted never to make trouble unless there is real occasion; even then the true-bred *Mastiff* rarely worries his victim unnecessarily, but is content with pinning or throwing him down on most occasions. There are rare exceptions, usually from bad rearing; but most of the savage dogs which have given rise to a contrary impression are *Bull-Mastiffs*, which, besides the bull-dog cross, have been trained as watch-dogs to attack others than their master.

Fig. 60.—BLACK-AND-TAN TERRIER.

Strange to say, the *Bulldog* (Fig. 61) himself, when pure, is not at all a ferocious animal as a rule. His intelligence is not, however, great, and his nervous system is most excitable; apparently slight causes may therefore rouse him and make him dangerous; and he is not a dog to run at large, though almost invariably most affectionate to all his owner's family. A bulldog cross, on the contrary, often produces a very vicious temper, as in both the bull-mastiff, used chiefly as a keeper's night-dog, and the bull-terrier, which was bred for fighting purposes originally. The bulldog himself, contrary to the popular belief, was and is scarcely ever used as a fighting dog.

The *St. Bernard* is a noble-looking dog, about the same size as the *Mastiff*, and, as a rule, with much the same qualities—though some fine animals are of very uncertain temper—in fact, if we may so express it, there is not the same calm *magnanimity* about a *St. Bernard* as about the other. On that very account, however, the dog is often a better companion, being more lively. These dogs are both rough and smooth-coated; the smooth-coated ones resembling a lioness even more than the *Mastiff* does, having much of that animal's peculiar slinging walk. The prevailing colour is reddish fawn in various shades, varied with white. The monks of *St. Bernard* object to the rough-coated dogs, which are, on the contrary, most admired in England; both came from the same stock, which had at one time to be crossed with the *Newfoundland* to save it from extinction, and thus was introduced the long coat.

The *Newfoundland* ought, when pure, to be all black; but the larger black-and-white dog, so often painted by Landseer, is now recognised as a distinct variety, under the name of the *Landseer Newfoundland* (Fig. 62). It need hardly

be said that both are capital water dogs, and admirable companions; no dog, again, more readily learns ordinary tricks. On the other hand, to keep this dog's coat in good order is rather troublesome to some people; and as age creeps on, his temper is apt to get somewhat uncertain towards strangers.

The large black *Retriever* (Fig. 63) is still worse in this last respect, or at least apt to be so.

There are many such

Fig. 70.—DANDIE DINMONT TERRIER.

dogs good-tempered enough, but it is significant that the majority of cases of people being bitten, so far as the breed is mentioned, are by these dogs, and in choosing a doggy inmate of the house one ought to consider, not only the home family, but its circle of friends.

The *Pointer*, when at all petted, is usually very affectionate and playful, but is not as a rule a pet dog. *Setters* (Fig. 64), on the contrary, often are—indeed there are few animals which manifest more real and intense affection for the whole family to which they belong than any variety of *Setter*; they are also most handsome in appearance, and we think this dog, as a household pet, is less general than it deserves to be. In fact we should be disposed to put the *Setter* at the very head of companionable dogs, for its appearance, affection, good temper, agility, and high spirits whenever a game is proposed. Besides the English *Setter* there is the *Gordon*, a black-and-tan dog, perhaps most suitable for indoors; and the *Irish*, a red dog. *Spaniels* are also good pets, but less agile than *Setters*, and often a little more uncertain in temper as they get old. This refers to the sporting or large *Spaniels*; but the small toy varieties, such as *Blenheim*, and *King Charles Spaniels*, are often worse (Fig. 65). This, however, is too often owing to the cruelly injudicious treatment on which we have already remarked; who could expect good temper from a wretched creature often tormented with dyspepsia?

Hounds, generally, are a large family. Those used in hunting sometimes

make good pets if brought up specially, rarely otherwise. The Greyhound family, whether smooth, or the larger rough Deerhounds, seem as a rule to possess only limited intelligence, and care little for any but one master or mistress, though we have known exceptions. Greyhounds are a little apt to be snappish. There has, however, been introduced from the Continent a hound that is a first-rate, clean, and affectionate house-dog—we refer to the Dachshund. It has a short, very smooth coat, more like sealskin than that of any other dog; but the most striking peculiarities are the extreme lowness of its body, and the peculiar way in which the very short forelegs are bent *outwards* from the in-turned knee joints, as shown in the engraving (Fig. 67). This dog is often about four times as long as it is high. As just observed, it is really a capital pet and house dog, the average weight being about twenty-five pounds.

The *Collie*, or Scotch Sheep-dog, is of the highest intelligence, and when young very playful; but as he matures becomes grave and sedate. He is most attached to his master and a select circle; but generally shy and reserved with strangers, and sometimes very short in temper with them. He is not a dog, in fact, that "cares to be bothered" with nonsense, and for this reason is not often a very good playfellow, though always a most devoted companion.

Terriers are a very large class of dogs, comprising many varieties; but all agreeing in being moderately small, lively, eminently companionable, *sharp* animals. As a rule it may be said that the Northern and Irish are

FIG. 71.—MALTESE TERRIER.

rough-haired dogs, and English smooth-coated. The old English terrier is black-and-tan (Fig. 69), very neat and handsome, and cleanly if well brought up. It is also bred very diminutive, and is then called a Toy Terrier, but these poor little animals are as delicate as an Italian Greyhound, which is the similarly dwarfed edition of the greyhound. There is also a smooth-haired White English Terrier, a dog of somewhat more dash and pluck than the black-and-tan, but similar in shape—this dog is sometimes queer in temper, and not very common. Somewhat similar to the white is the Bull Terrier, also white, and bred from the white terrier with a cross of the bull blood. This dog is a first-rate guard to his master, but very apt to be dangerous to strangers. The most general and popular of all smooth-haired terriers is, however, the *Fox Terrier*, a neat, corky, game little dog, mostly white with coloured patches (Fig. 66). Alert and courageous, this dog is nevertheless good-tempered and cheerful, and makes a first-rate pet and companion, being also neat and clean in the house, and a lively watch-dog at night, barking readily, as in fact most terriers do.

The old Scotch Terrier is rather large—for a terrier—with a wiry, not over-long jacket. More or less like him are various types of Skyes (Fig. 68), some with pricked-up ears and some drop-ears, some with rough and wiry, some with very long and silky jackets. In the Border counties is largely found a peculiar-coated,

bluish Bedlington Terrier, of bad, or at least uncertain temper; and there is also the Dandie Dinmont (Fig. 70), a very long, low, rough-coated little dog. The Irish Terrier is a larger rough-haired dog, rather high on the leg, and usually of a more or less sandy or wheaten colour. He, too, is a good-natured though game dog. Almost without exception, terriers have a strong antipathy to the whole class of furry animals called "vermin," and there is, in fact, little doubt that the generic name came from the Latin *terra*, and signifies "earth-dog," or dog that goes into burrows and drags or drives out the vermin. Hence all are of high courage, and always hunting about hedges, ditches, or drains, except the more daintily-bred Skyes, and a still more silky-haired breed called the Yorkshire Terrier. This latter dog makes a lady's Lapdog, but like the Skye, it is a great deal of trouble to comb and keep its coat in order. Of a similar class is the white, long-haired, delicate Maltese dog (Fig. 71).

The Pug is a good lady's dog, its short coat giving little trouble, and being very good tempered; but it is too lazy to make a nice pet for boys. Its skull much resembles that of the Bulldog on a small scale.

The Pomeranian is a dog of quite the contrary character. Its sharp nose gives it a likeness to the fox—it is called the Fox-dog by some, and by others the Spitz-dog—and its bushy curled tail and long coat, generally white, are well known. It barks on the very smallest provocation, and is rather apt to be snappish as well; when not so its temper is fair, but the snappish ones preponderate. It can be taught tricks.

Fig. 72.—POODLE.

But the trick dog of all is the Poodle (Fig. 72), which is less known in England than he deserves to be, though popular on the Continent. He is evidently allied to the Water-spaniel, and possesses nearly all his qualities. He has a fine nose, and makes a first-rate sporting dog if well trained; but above all, he is good tempered, fond of his master, and of children, most obedient if kept in order properly, and can be taught—anything. His long coat wants attention; but we think it a pity to see it cut, as so often it is, into a ridiculous resemblance of a maned lion. The majority of performing dogs are Poodles.

To conclude, be kind to your dog, but always be his master. In teaching tricks, it is useless to begin till you have thorough affection and confidence. After that, the golden rule is patience—patience—patience. Whenever the dog makes the least step toward what is wanted, at once reward him by a tit-bit, or at least a pat and hearty praise, which he well understands; and never continue one lesson *very long*. These are the main secrets; a tired, wearied animal never learns. A dog ought to learn tricks as part of his *play*, and if taught by a *lad*, who loves him generally will do so, if too much is not expected at once.

HARES.

THESE animals can only be tamed when taken young, but when thus reared in confinement they will sometimes breed, and there is little doubt that patience for a few generations would produce a domestic animal as tame as the rabbit, which in a state of nature is equally wild. Cowper's tame hares are remembered by everybody, and used to go at liberty in the parlour, as rooms were called in those days. As a rule, however, hares are kept in hutches, and there is no difficulty in taming them when caught young enough.

Generally speaking, hares may be managed as rabbits, but may have, and indeed should have, rather a more liberal supply of green food.

RABBITS.

It is not every one who has rabbits who can command a regular "rabbitry," in the shape of a nice enclosed shed, with window and locked door. The best rabbit-breeders have such, sometimes of great extent, and the better the shelter the better for the rabbits of course. Any shed high enough to stand in will make a nice rabbitry on certain conditions. These are—that it is dry, weather-tight in walls and roof, well ventilated at the top and nowhere else, and well lighted. Rabbits will not thrive without light, so that a window is important. On the other hand, glaring sun for a long period in summer full on the hutches may cause much suffering, and should be avoided.

All that need be done to such a shed as supposed is to see to the floor. Paving-stones or flags make an excellent floor, but will be rarely found, and bricks or earth soak up the urine, and thus cause ill-health and foul smells. Therefore such natural floors should be covered over smooth and flat with concrete or cement made of brown lime mixed hot with sand or fine gravel. If this is to be laid on earth, it should be trodden or beaten hard first, and some small broken brick or small stones beaten in to make the cement bite and hold, and a brick floor should be washed and the cement laid while damp. On brick, half-an-inch deep will be enough, and any boy can lay his own floor with a shovel and trowel, at the cost of a few pence for the materials. Let no one go on the floor till it is thoroughly hard, and you have one which can be kept beautifully clean with hardly any trouble.

Even a rough shed open at the front is far better than none at all, and if even this cannot be had, a large door or shutter fixed over a couple of hutches will give a deal of shelter. Or a double tier of hutches may be constructed one over the other, with a projecting and slanting top to the top tier, and a curtain of heavy canvas to drop down at night or in bad weather. But rabbits thus exposed to the weather are exceedingly subject to "snuffles" (the influenza of rabbit kind) and other diseases, and it is far better to put up a house if possible, or to fill in the front of an open shed with board. It pays; and a rabbit-house can be put up in the same way as described for a fowl-house, with very little expense, by any lad as handy with tools as a boy ought to be. Let the air go in and go out at the top and bottom of the front of the shed, while the hutches are at the back, then there will be plenty of air without draught.

The next thing to think of will be the hutches. For the prosperity of the rabbits these should be large enough. A breeding-hutch for lops, or rabbits as large, should not be less than three feet long and eighteen inches from front to

back, and fifteen inches high in the clear, but a little more will do no harm. Smaller rabbits will do with thirty inches long, but liberality pays well. Say we have three feet. Then a partition must be put in a foot from one end, to make a

sleeping chamber. Near the back end of this, close to the bottom, must be a round hole (A) for the doe to pass in and out, capable of being closed by a shutter (B) working in slides (Fig. 73). This hole will be just large enough to allow the doe to pass with comfort. The front arrangements, in general, had better be as in Fig. 74. The sleeping room is here shown, fitted with a door (B) opening outwards, and inside this slides in grooves a shutter (C) about half the height. The advantage of this is that a peep may be taken at the young ones without removing them and without any danger of their falling out, as the doe commonly makes her nest right

FIG. 73.—SECTION OF INTERIOR OF RABBIT-HUTCH.

against the front. The front (A) of the living room must also open outwards, either from the top or side, both doors fastening with buttons, bolts, hooks, or any secure way preferred. The open front may be made in many ways. It is shown in the usual style of iron rods fixed in a wood frame at about an inch apart. Wooden bars are sometimes used, but are the worst of all, as the rabbits gnaw them to pieces. Pieces of hoop-iron punched at each end and nailed on do better, but look bad, and keep the owner from seeing much. Others fasten galvanized wire netting, about three-quarters of an inch mesh, over the frame with small staples. The neatest and best is a front entirely of wire, made by a wire-worker, with a stout wire all round the edges, the rest of the cage woven and galvanized. This costs more than home-made work, but not more than the orthodox iron-rod plan. A capital job may be made with sugar-boxes and wire netting and a few small galvanized wire staples.

The really most important thing about the hutch is a floor that can be kept clean. Some people make a false bottom of wire netting, bars of wood, or board pierced with holes, and two inches under this have a zinc tray, which is removed to clean. Our advice is to have nothing of the sort; firstly, because it is apt to hurt the feet of the stock, and more especially because it always leads to neglect. Fix the floor slightly on a slope to the back, and have a loose but solid board to slide out. Paint this board thoroughly, and when the last coat is hard dip it in a

A

FIG. 74.—FRONT OF RABBIT-HUTCH.

made thinnish, a layer of which will adhere. This will bear scraping beautifully. Under the back edge, cut all along a groove in the fixed floor of the hutch, and line it with a zinc gutter which should project from the end. The urine will then run off the loose board into the gutter, and drain off into a bucket which should be kept under the spout, and every morning the board should be scraped clean, washing a little with water and a stiff bristle brush if necessary. The cement will bear this, and the loose board can be renewed occasionally without altering the rest of the hutch. When all is clean, sand pretty thickly with fine sand.

Hutches must never be placed next the wall or on the ground. If possible, one

should not be placed on top of another; but if space is limited this cannot always be avoided. In that case be *very* particular that leakage is impossible from the top floor into the bottom one. The bottom ones should be on stands or cradles, at least a foot from the ground, and a bucket always kept under the spouts which carry off the urine. Another bucket should receive the solid excrements, and both be carried outside, and some deodorizer applied every day. If the smell is at any time offensive, it is a sign there has been neglect, and this should be remedied or there may be disease.

The best bedding is oat straw or wheat straw well broken and bruised till soft; a good deal of it will be eaten. It should be renewed once a week, and it is well now and then to sprinkle some powdered sulphur in it; a pinch may also be sprinkled on the food occasionally.

Bucks are kept in hutches without any partition, but the sleeping end should be fenced off or guarded by board, and not left open.

And this brings us to the all-important question of feeding, about which many mistakes are usually made by young fanciers. The chief one is giving too much green food, and giving it wet. It is true herbage is the natural food of wild rabbits; but in their case the effects are tempered by constant exposure, and active, even violent, exercise. Even so, however, we see that the result is very small size, though the food is abundant. In confinement, at all events, it is found that green food must be limited and given with care, and that when given too freely, or above all wet, the old rabbits go wrong sooner or later, and the young ones die off with what is termed "pot-belly," the abdomen swelling and feeling tight as a drum. Every boy almost knows or has heard of this scourge of the rabbit-keeper; and it is as well to say at once, that it is the known result of injudicious feeding.

Some kind of grain or seed, whole or in meal, is the basis of sound rabbit food, and the best is the cheapest. Some who have heard of the necessity of "dry food" give bran: it is most wretched stuff. The finer bran called "pollard" in some places (in some pollard is *coarser* bran), and thirds or sharps in others, is better, but solid grain is the right thing. Oats make the best staple, and may be given (1) dry; (2) soaked all night in water, then drained; (3) boiled till it swells; (4) crushed and slightly damped; all these things are good for change. Oatmeal is generally too expensive, else it is good. Barley meal and Indian meal are good occasionally. Bread is useful mixed with a little bran; bran this way is useful, supplying what the bread lacks. Beans or peas (split or whole) soaked a night in water are good, and so are lentils or barley, or wheat when cheap. Rough rice is also a good change. Bread and milk is very useful for does with young ones. In every case variety—change—is a grand necessity for health and really fine condition, and we will give directly a dietary table for a week. But first we must consider the green food, for rabbits must have *some* of this, though not too much.

Taking the matter alphabetically, any of the following may be given on emergency: Acorns, apple, artichokes, beet, broccoli, cabbage, carrot, cauliflower, celery, chicory, clover, comfrey, green corn, dandelions, dock, elm leaves, endive, fennel, grass, hare parsley, lettuce, lucerne, mangold, marsh mallow, milk-thistle, parsley, parsnip, pea vines, pimpernel, thyme, trifolium, turnip, vetches. Acorn must be given in very small quantity on account of its powerful astringent properties, which might cause stoppage of the bowels; and cabbage is, perhaps, the worst of the lot, being windy and watery. It will be seen that the "cabbage and bran," so often supposed to be the correct thing, are about as wretched diet as could well be hit upon. The very *smell* of a rabbitry where much cabbage is given is a sure sign that it is bad. They are handy, and we *must* use them sometimes—but take care. Hare parsley is very wholesome, and it is worth cultivating if possible,

especially as rabbit manure suits it admirably. Care must be taken not to confound it with the poisonous hemlock, which is a *little* like it. The hemlock, however, has round stems, is *dark* green and smooth; while the other is a triangular stem, lighter green, and rough. Clover, vetches, and such like farmer's crops make excellent food, and so do comfrey and dandelion.

It is particularly important to give all green food *dry*. It does not hurt fresh if plucked on a hot day; but it is safer always to shake and clean it well, spread it a little in the shade, and keep it thus twelve hours in summer and twenty-four in winter. Thus treated it may be given with tolerable freedom. Roots are a good change with green food, and less risky: they are cut in slices. Potatoes must not be given raw, but boiled and mashed with the skins make good food for an occasional meal, with a little bran sprinkled on them. A few tea-leaves, again, make a good and palatable addition in winter when green food is scarce.

We strongly advise feeding three times a day, as rabbits are dainty in their way, and often turn away after eating a bit, and then refuse to touch the same again. It is therefore best, and *kindest*, to give only a little at a time, and keep them rather hungry. All the soaked or mashed food is as well boiled, and then left to cool down to warmth, to allow it to swell. And now, with these general remarks, we will give a specimen of a dietary table for a whole week, from a standard authority.* It need not be adhered to, of course, but it will show what we mean by variety, and how rabbits should be fed.

SUNDAY.—Morning: roots and dry oats. Afternoon: green food and hay. Evening: mash of potatoes and meal.

MONDAY.—Morning: roots, crushed oats and tea-leaves. Afternoon: a small quantity of green food and hay. Evening: bread and meal mash.

TUESDAY.—Morning: soaked oats. Afternoon: roots and green food. Evening: crusts of bread (dry).

WEDNESDAY.—Morning: barley or wheat, dry. Afternoon: green food and hay. Evening: mash of meal and pollard.

THURSDAY.—Morning: roots and dry oats. Afternoon: green stuff and hay. Evening: soaked peas or lentils.

FRIDAY.—Morning: hay and roots. Afternoon: green food. Evening: meal and potato mash.

SATURDAY.—Morning: dry oats and chaff. Afternoon: green stuff and roots. Evening: bread.

Hay is excellent food, having many of the qualities of green food without its dangers. Still, it will not take the place of fresh vegetables. In France, one of the most celebrated breeders makes *soup* out of pot liquor and vegetables, and gives it to his rabbits two or three times a week, or to nursing does; but we should advise caution in such experiments. As winter draws near, however, when green food is scarce, care should be taken to make the needful changes very gradually, and it may be necessary to give a little water, slightly warmed, to partially make up for it. The quantity should never exceed one-third of a pint to each rabbit, and this ought to be given at twice. The meal mashes must be mixed rather crumbly, not sticky, and should be put in the troughs in crumbly lumps, not "plastered" in with a spoon.

Some sort of a trough is necessary, and that given in Fig. 75 is one of the best. Rabbits pull about their things if they can, and waste a great deal, and young ones will lie in the trough if possible. To avoid these things, the trough is made semicircular, like a gutter, but lapped over the wooden case to prevent this from being gnawed; and the wires prevent the wood from being scratched out. Two rings

* "The Practical Rabbit Keeper."

or staples must project from the side, and these coming through the bars or wires of the hutch are secured by two bits of stick. For single bucks a smaller trough will do. Remember our caution, that rabbits will not eat food they have once really left, and only give enough. Often double the food is used that ought to be, and only wasted. Hay is best given in a kind of manger rack, made of a few stout galvanized wires bent and forced into the roof and side of the hutch at the back corner, opposite the partition door, high enough to cause no danger of knocks. The green food may be placed there also; but in a clean hutch it is almost as well on the floor.

Fig. 75.—FEEDING-TROUGH.

BREEDING.

Doe should not be bred till they are eight months old, and the buck ought to be a year, though he may occasionally be used two or three months earlier. A doe should breed very well for three years, after that she begins to fail. Many does are much over-bred, which weakens them, and the best authorities recommend only four litters a year, which may be middle of February, early in May, late in July, and early in October. Winter litters are double the anxiety, weaken the doe, and seldom thrive, and fewer litters make finer rabbits. The doe will generally show her readiness to breed by restlessness, greater disposition to be petted, and carrying bedding in her mouth. The doe should only be left with the buck about ten minutes, and if she declines him should not be forced, but removed and tried again the next day. Does should never be pulled about or handled with the idea of finding out if they are in kindle. They generally are, and about twenty-five days after their visit to the buck will show signs of wanting to make a nest, tearing up bedding, and even plucking fur from themselves. Some are much earlier than others at this; but, anyway, the hutch should then be most thoroughly cleaned, or the doe put into a clean one, as she must not be meddled with again. Supply her also with ample soft straw and hay, and a little cotton wool may be tried if you want to save her own fur. The young ones should be due on the thirtieth day, and for the last four or five the doe should have a few table-spoonfuls of water, very slightly warmed, twice a day. You must be very careful to keep all quiet as the day approaches, never letting her be frightened by dogs or cats coming in, or any sudden noise. It is as well to tack a piece of sacking over half the open front of the hutch, the end next the partition, so as to keep her still more dark and quiet going in and out. A loud bang may lose the litter, and so may a thunderstorm; the last you cannot help, but the other you may. Rather more barley meal may be given just now as mash, and moistened with a little milk and water, and, if possible, some of the more juicy vegetables, such as endive and milk-thistles; and after the doe has kindled, some bread and milk (rather dry) may be given every day with advantage. It is easily understood that the animal is not so endangered by moist and green food, and, indeed, requires more while suckling.

The doe should not be disturbed the first day; but on the second, when she is out feeding, shut the slide to keep her a minute, open the door of the nest box, and take a peep. Here the half-slide, already described, will be found useful. Count the young, remove any dead ones (if there are any), and take a swift but thorough view of the lot. There may be too many—no doe can rear over six with

any chance. If so, one or two *must* be either killed or given to some other doe; for which reason it is always a good plan, if possible, to put two or three does to the buck the same day. In the large breeds four will tax a doe sufficiently. Again, if there is a very small rabbit it is best to kill it at once; such scarcely ever even live, never thrive, and yet keep milk from the others. Any transfers must be made with some art, or the doe will find out the spurious progeny. When the doe goes to feed, slip down the trap, make the change, and cover up the lot with bedding just as they were. Leave them thus for an hour, keeping the doe out. By that time the strangers will have acquired a deal of the smell of the doe's own family, while she will have so much milk she will be glad to get rid of it without asking too many questions. One of a doe's own litter should always be left.

The young are born naked and blind, but soon acquire fur. One would think they would be suffocated, covered up as they are: but there need be no fear of that. Soon after a fortnight they will begin to crawl out to the trough; and as soon as ever they do crawl out of the nest the bedding should be entirely changed. The chief thing is to keep them from too much green food, and the best plan is to keep this in the rack, and put plenty of bruised oats in the trough for them. The doe must be fed *ad libitum*, and will want nearly double what she does at other times. She should be allowed to eat at least her daily mash at peace, shutting the trap and keeping her young ones away the while. A little later the young ones may have a run on the floor of the rabbitry while the doe feeds. They should be left with the mother from seven to nine weeks, taking away one at a time only, and placing with other young rabbits. The doe may usually be put to the buck about a week later. The young rabbits may be kept together for thirteen or fourteen weeks, but after that the bucks must be separated. Does may generally be kept three or four together in a large hutch till six or seven months old.

A few complaints of rabbits should be briefly noticed. *Pot-belly* has already been treated of: it does not bother much with proper food, but "bran and cabbage" will cause it at any time. *Canker of the Ear* is best treated by syringing gently with extract of lead (poison). *Red-water* usually arises from ammoniacal vapour—in other words, want of cleanliness. Barley-water is one of the best remedies, giving oatmeal as mash for a few days. *Snuffles* is an influenza cold, caused usually by draught or damp. The chief symptoms are running at the nostrils and swollen damp eyes. Sponge the affected parts with warm tea every day, keep dry and warm, and give a few drops of camphorated spirit twice a day; or a drop of tincture of aconite on the food. *Scurf*, a scaly disease of the skin, may usually be cured by dusting sulphur into the coat, and sprinkling a little on the food. It is good, as already observed, to give this once a week or so, and this will greatly prevent such mishaps. *Sore Hocks* arise from false bottoms, dirtiness, or heated blood—this, and scurf or mange, may arise from *too little* green food. It will rarely arise in hutches kept as we advise; if it does, dress the places with zinc ointment, and give hay on the floor for a few days. The clean dry sand mentioned is almost a preventive.

VARIETIES OF RABBITS.

Of fancy rabbits, the most ancient and highly esteemed is the Lop, or Lop-eared breed, which is much improved to what it was formerly. At one time length of ear was almost the only point taken into consideration with these rabbits; later, certain markings, known as "smuts," or regular dispositions of broken colour and white on the face were highly esteemed. Rabbit shows have improved matters farther: and size, beauty of proportion, eye, and other points are taken into consideration. Yet with this has been attained greater length of ear than ever, so that while twenty years ago a rabbit that measured eighteen

inches from tip to tip of its ears would have been thought first-rate, a rabbit must now measure twenty-two inches to be thought good, and twenty-four inches have been measured on several occasions. At the first growth of rabbit shows there was much cruelty practised in stretching the ears; but this is now detected, as it produces a *hard and knotty* harsh ear. Any rabbit whose ears feel thus to the touch has been unfairly treated, and considerable deduction for unfair and unnatural stretching must be made by the purchaser. A graceful carriage of the ears, as in Fig. 76, is as important as a good length; and so also is width of ear. A protuberance under the chin, termed the dewlap, is also highly valued. The head should be carried well up above the shoulders, and the back rises behind in a graceful arch. Sometimes the ears are a very good length but do not fall properly down (Fig. 77). This simply shows that the ears are extra strong and thick, and although such a rabbit would not do for a show, it may be very valuable for stock, more especially in a buck. Other faults in the carriage of the ears are for both to hang forward over the face, or for one to stick up and only one hang down. But all such rabbits may breed good stock if there be only *enough* of ear.

Fig. 76.—LOP EARS.

Stock rabbits for lop-breeding should not be less than twenty inches, and as near twenty-two as possible—vigorous animals. To keep up and increase his length artificial *heat* is necessary, or rather a uniform warm temperature. This has been over-done in some cases, rabbitries having been found heated to ninety degrees. It is said they get “used” to this, and to a certain extent they may; but, nevertheless, animals must suffer severely in such a temperature, and the constitution is ruined. We are sure from experience that seventy degrees is ample, and many fine rabbits have been reared at sixty degrees, which needs no artificial heat in summer, except at nights.

The great thing is to warm the rabbitry at night and in winter, and without this it is quite certain great length cannot be kept up. A small gas stove, well ventilated, is safest and handiest. Besides this, however, the ears of the young rabbits require attention, placing them upon the lap, and gently “working” them down, without any pull at all. This gives no pain, and the rabbit will readily eat the while; it is chiefly necessary to *ensure* a graceful fall, and prevent in due time the faults of carriage already described. This method is far better than the plan some pursue, of tying pieces of lead to the ears till a fall is secured, or making the rabbit wear a leather cap.

Fig. 77.—OAR EARS.

Lops are bred of many colours, “*selfs*” being the same all over. Of these there are fawns, sooty fawns, yellows, blacks, greys, and blues, all which should be solid and free from white hairs, and (except greys) from grey shades or patches. Blacks can be paired to black or black and white. Blue is a slaty colour, not very pretty, and can only be paired with sooty.

Fawns and sooty fawns will breed well together, or with almost anything, and also breed excellently with a black buck, sometimes producing tortoiseshells. Yellows also breed well with blacks, throwing sooties, yellows, an occasional black, and broken colours and tortoiseshells. If a buck is kept, a good sooty is far the most generally useful and certain in his offspring.

The best broken colours are black and white and tortoiseshell. For the first, a black and white of either sex should be paired with a black. Grey and white is also pretty, and often comes from sooty and black and white. White, fawn, and black is called tortoiseshell, and can often be got by pairing a sooty with black and white. In all broken markings there should be plenty of colour, whatever it is, and it is a great point to have a good "smut," or a nice patch on each side of the nose, joining a little in the middle. When a nice large well-defined patch on each side thus meets at the nose, we have the old "butterfly-smut." Some rabbits have a stripe down the back and small patches on the sides; such will never breed any decent marking at all, and should be got rid of.

First-rate Lops have been sold for £20, and £5 is very common for real quality. The does are rather impatient of interference with their young, more so than most, but otherwise the Lop is a good mother.

The *Himalayan* (Fig. 78) is an extremely pretty variety. In size it should be medium, weighing from seven to eight pounds. The shape is very tight and sprightly-looking. The main points are in colour and marking, and are very easily described. The eyes are pink or red, the whole body pure white, and all the extremities—technically called "points" in a special sense in this breed—dark; that is, nose, ears,

Fig. 78. HIMALAYAN RABBIT.

feet, and tail. Now and then these are found almost jet black, but this is rare; in most cases a very dark chocolate, verging on black, is all that can be got, and is reckoned very good. The general run would have chocolate nose and ears, the feet being grey, but such would be useless for showing. It is, in fact, very difficult first to breed a first-class Himalayan, and then to keep it in good colour; for the feet, even of a good one, which are in tip-top order one week, may be grey the next. Experience has, however, shown that the cause of this is the strong chemical action of the urine on the feet, and that by making the floor of the hutch rather more sloping than usual, cleaning out daily with rigid punctuality, and giving an inch depth of sand, it may largely be prevented. All the sand need not be removed, but only the soiled portion, and it must be sifted fine, or gritty pieces may cause sore feet. Of course about moulting time, or when in bad health, or kindling, the best rabbit may go off in colour.

For breeding, good dark-pointed parents must be chosen, the points extending rather too far up is no detriment. This pretty rabbit is extremely hardy. The young are at first all white, and the points come by degrees, seldom being complete till six months old.

The *Angora* rabbit (Fig. 79) is a handsome variety, but very troublesome. It is rather larger than the Himalayan, but looks a great deal larger, owing to its long coat. The distinguishing characteristic of this rabbit is this long coat, which resembles in touch well-combed fine wool. The usual colour is white, but colours are sometimes seen. The eyes are pink, as in most white animals. The ears should be

upright, but a moderate temperature is found to promote length and fineness of wool, and this gives often a tendency to length and to lopping, as in the lop-eared. This, however, is a fault. The doe is prolific and fairly hardy, and the race is very tame and quiet. The doe takes fur from her breast when nesting, so that an exhibition rabbit, if wanted to be shown, must not be allowed to breed too often; sometimes a supply of cotton-wool will induce her to desist.

The great drawback to this breed is the trouble it gives. The hutches must, of course, be kept very clean, and the coat must be kept free from knots by combing or brushing, or both, at regular intervals. Whenever knots are found, they must be wetted with warm water and worked at patiently till reduced, or cut off bodily, as they check perspiration, besides being unsightly. The metallic wire brushes, which act partly as a comb, are the most useful implements of any for keeping Angoras in good order.

Fig. 79.—ANGORA RABBIT.

The *Siberian* rabbit appears to be a cross between Himalayans and Angoras. It is an Angora with black points, and the combination does not appear worth the trouble of production. The so-called Polish rabbit seems to be a small and weakly kind of Albino, with extremely white fur all over, and very pale pink eyes.

The *Dutch* (Fig. 80) is also a small rabbit, but the most hardy and prolific of all the varieties, while it is also tame and good-natured. These qualities make it most valuable as a nurse to other more valuable sorts. Some people try to get it as small as possible, which is a great pity, as tending to destroy these useful qualities, and make it delicate. Such would prefer rabbits three and four pounds weight only; others, with more reason, allow six pounds, and even more. The main points of the breed lie in markings, which are peculiar. There are two styles of this. In what is known among fanciers as the "old" style, shown in the engraving

(Fig. 80), a very broad white collar extends from the cheeks to just behind the fore-legs, which are all included in the white. A white blaze, rather broad near the nose and tapering backwards, runs over the forehead between the ears and joins this, leaving coloured cheeks and ears, and the hind feet are also white, all else coloured. In the "new" style the white collar is narrower, stopping in front of the fore-legs; the blaze up the face is narrower, and only the fore-feet are white, not the legs; the hind feet are white, as in the other.

Fig. 80.—DUTCH RABBIT.

The colours of Dutch rabbits are black, blue, grey, yellow, and tortoiseshell. The majority bred will be more or less imperfect in marking, the perfect ones being very rare. It will be found that sometimes putting a very dark buck, coloured almost all over, but with tipped feet and narrow blaze, to an old-styled

doe, will sometimes produce a good new-styled rabbit; but, on the whole, Dutch breed the most uncertain of any of the varieties.

The *Silver-grey* rabbit is universally admitted to be allied to the Himalayan, but the precise relation is rather doubtful. It is singular that while the young of Himalayans are white, those of the Silver-grey are *black*. The size is moderately large, and the form and attitudes very alert and sprightly. The chief point is the colour of the fur. When mature, this usually consists of a bluish ground, all the longer hairs being a mixture of black and white, which gives a peculiar sharp silvery appearance, like the fur of the Chinchilla. Some breeders prefer a darker shade than others, but a medium is the prettiest and most valuable. To keep a medium colour it is well to pair the darker with the lighter shades; but the grand difficulty is to obtain the same shade all over—without the noses, feet, or other parts being darker than the rest. In-breeding almost always injures the colour. The skins of good Silver-greys are valuable, and readily purchased by fur-dressers, many of the so-called Chinchilla furs having no other origin. These rabbits are hardy and fairly prolific, but *very* wide-awake, and require patience and kindness to become tame, more than some others. The doe will not brook much interference when she has young ones.

About the year 1875 a variety of this rabbit became popular under the name of Silver-cream. This colour consists chiefly of a frost or silver upon fawn or yellow, instead of blue-black. It is rather popular among fanciers for its greater difficulty, but the colour itself is not so valuable or attractive as the Silver-grey. Silver-greys and Silver-creams should weigh as near ten pounds as possible.

The Belgian Hare is a very large rabbit, weighing nearly ten to twelve pounds. The ears should be erect, but rather long; any lop in them denotes usually a lop-cross. The usual colour is sandy with a black shading, something like sooty-fawn; and the whole shape and appearance as much like that of a hare as possible. Some are wonderfully like, but they are still true rabbits, and not hares. They are fairly hardy, but not very prolific, few does having more than six at a time, and three or four very usual. It requires a large breeding-hutch to do well—four feet being not too long.

There are still larger breeds of rabbits. The sort commonly called Patagonian comes from Belgium, and often reaches twelve to fourteen pounds, some sixteen. It is doubtful whether it is a really pure breed; and our own opinion is that these rabbits and those called Flemish giants are produced simply by crossing the large stock of the country, or Belgian Hares, with *any* large buck that comes handy, lop or otherwise—the traces of lop in these rabbits being sometimes very conspicuous. These rabbits are mostly very hardy, and the bucks pretty tame and manageable. Like the Belgian Hare, they seldom have many at a birth.

Large rabbits are best bred on the Flemish plan, by crossing the stock does with any very large buck of another family, and never breeding from relations.

GUINEA-PIGS.

GUINEA-PIGS (Fig. 81) were originally natives of South America, and are very common in the La Plata district, where the animal is called the *Aperea*. In its native country it will either burrow like the rabbit where the ground is dry and sandy, or lie amongst the herbage like the hare. Most of the guinea-pigs known in Europe, however, have been bred in captivity for generations, as they bear any ordinary climate very well, and could be easily bred in warrens if it were worth while. Few people, however, like their flesh, though we have heard it called

"delicious;" and their small size makes them far more subject to the attacks of predatory animals, such as cats and owls. They are, therefore, perfectly useless for any purpose, and only kept as pets. Some one or other stated many years ago that their smell drove away rats, and the statement was copied again and again till it grew into a common belief. We never could find that one or more guinea-pigs ever had the least effect that way, and we do know a case in which the rats devoured the poor guinea-pig!

Guinea-pigs are found white, black, and yellow, and various mixtures of these colours; but it is singular that an absolutely black one—all over—is almost impossible to find; there is colour on a foot, or ear, or somewhere. The price at bird-shops varies from sixpence to two shillings, according to the sex, size, and beauty. They will thrive capitally in any small rabbit-hutch, or box similarly designed, with a day-room and sleeping-box; and should, in fact, be treated generally the same, giving a fair proportion of dry food, and a fair quantity of herbs or green food, with tea-leaves for a treat or occasional stimulus. They may also have a little bread and milk.

The female guinea-pig goes with young for three weeks, and generally suckles them for three weeks more.

Fig. 81.—GUINEA-PIGS.

Unlike the young of rabbits, they can see when they are born, and have more or less hair. They are extremely cleanly in their habits, and if a young one gets in a mess the mother will have no more to do with it. The average number of young ones is from four to six. They should not be allowed to breed until six months old, or the stock becomes weakly and dwindles away, and care should be taken to buy or exchange a fresh boar occasionally.

SQUIRRELS.

THE Squirrel makes a beautiful and engaging pet when moderately tame. A full-grown one will measure from six to eight inches from the nose to the root of the tail, and there is something irresistibly attractive in the way it sits up to eat its food (Fig. 82). No animal is so pretty in its ways, and this accounts for its being such a favourite. A squirrel can generally be obtained at a good bird shop for from three to ten shillings, according to its beauty and abundance of fur, a good-tailed one being worth a great deal more than one poorly furnished. The great thing is to get a young one, and the best guide on this point will be the look of the teeth, which in an old squirrel are yellow, in a young one clear white. It is useless buying an old squirrel, as it will either remain savage and vicious, or what is quite as likely, pine away and die. It is not much use trying to get a tame one, as it will be nearly as shy with a new owner, and very often those sold as tame, especially by men in the street, are simply stupefied by opium or some other drug. It is far more satisfactory to look out simply for a young and

healthy animal; and the best time of year to buy it is the autumn, when it is in the prime of health and condition from its plentiful summer food.

The squirrel is by no means easily tamed; but kindness and patience will have the usual result, especially if the owner takes care always to give it its food, and never leaves that duty to others. It is often of great service to smear the hands now and then with a drop or two of oil of aniseed, most small animals being very fond of the smell.

The cages ordinarily sold for squirrels, and resembling the revolving cages sold for white mice, are not to be recommended. For one thing, they are not nearly large enough; and in the second place, they give the squirrel no rest except when it is in the sleeping-box. Now, though a squirrel likes the treadmill exercise in moderation, it does not want to be *always* at it; and—not to put too fine a point upon it—such a cage is really cruel, while its small size will never show the real beauty and winning ways of the little animal, which, unlike the mouse, is formed for the very freest and most

Fig. 82.—SQUIRREL.

active exercise. The squirrel is *worth* a far better cage than that. A proper cage will be rather expensive if bought, but a clever lad, by buying a wire front and some wire, can make one easily. Fig. 83 gives a good idea of a much-improved modification of the common cage. The square cage, fitted with a plain wire front, should be at the very least eighteen inches high, and a foot square—if larger, all the better—and in this a perch or two can be placed. On one side of this, communicating by a hole pretty high up, is the nest-box; and at the other is the treadmill, easily made by cutting two circular pieces of thin board, and joining the edges together by stiff wires at the proper distances. In such a cage the inmate has the option of using either his wheel or the square cage, and will be much more comfortable.

But even this is hardly fair play for a squirrel, and there is a far better plan yet, based on its natural habits. That is to make a *large* square cage with a wired front, like a small aviary, which need not cost much if the front simply be purchased and the rest made at home (Fig. 84). Three feet square, or even more, and any height from four to six feet, will make a capital cage. In this fix *natural* perches by selecting a small-sized branching tree-stem (this is best, and looks best, but of course formal perches about an inch in diameter may be made to do), and let a revolving wheel open on one side turn on a pin fixed in the side of the cage. This wheel can be made of one circular piece of board, into the edge of which are driven thick wires or rods, connected by a circular wire at the outer end, thus making the wheel open like a cup, as shown in the cut (Fig. 84). Out in the middle, or rather towards the opposite side from the wheel, fix a swing, made

Fig. 83.—SQUIRREL CAGE.

by hanging a perch an inch thick and eight inches long by swing-wires from the roof; and in some corner rather high up fix a nest-box.

In such a cage as this a squirrel will not only be far more healthy and happy, but there is a fair chance that, if a pair can be procured, they may *breed* in captivity, which is a great triumph for the proprietor. The best chance of this will be to leave the mother pretty much to herself, only providing some cotton-wool or other material, such as soft clean hay, some days before the young ones are expected; and if any are born, providing rather more bread and milk than usual. The usual number of young ones is four.

And that brings us to the last thing—the diet. Squirrels may be given nuts, acorns, chestnuts, walnuts, and such-like, with some drier food, like maize or wheat, or pieces of dry bread-crust, and avoiding oily seeds like hempseed, except a grain now and then. Besides this, give a little bread and milk squeezed rather dry, and never left to go sour. This will be the staple diet; and, as above noted, if the female has young, a little more bread and milk should be added. For tit-bits, occasionally some little bits of meat are often relished, but must be given sparingly.

Fig. 81.—LARGE SQUIRREL CAGE.

The cage must be kept clean, and shells and all other refuse regularly cleared away, and some clean dry earth strewn on the bottom. Some people say that a small turf put in every day or two helps to keep them in health, and it is far from improbable. A loose piece of wood or two should always be about the cage for the squirrel to gnaw.

RATS AND MICE.

MERELY as pets few animals are more attractive than these, on account of the facility with which they may be handled. A thing does not seem really your own unless you can take it in hand and look at it, and pull it about in all sorts of ways; and these animals lend themselves to such proceedings more readily than almost any other—in fact most of them evidently enjoy it.

We will take first the *Dormouse*, since this animal is a sort of connecting link between the rat and the mouse tribe, and the squirrel. It resembles the squirrel in many habits, and in its method of feeding—sitting up on its hind legs and holding its food in its paws; but the teeth are more like those of the mouse. It is a fat, plump little animal, considerably larger than a common mouse; it has much more fur, and the tail, which is rather short for the size of its body, has more fur at the end, which makes it look almost tufted. In the winter it hibernates, or goes to sleep, in a nest made of moss, hair, soft leaves, &c., and this period is the best time to catch it; in fact it is not easy to catch a dormouse in any other way.

It is rather difficult to keep in health, and we expect the reason is generally a want of study of its habits. If kept in a warm place it will wake out of its sleep; but it is pretty certain that this must be bad for it, and that when the

cold autumn days come on it would be far better to give it plenty of nest material, put it in an unwarmed place, and let it follow the instincts of its nature. The food, again, is not always judicious. The dormouse will eat nuts and apples and such like readily enough, and such food, with dry seeds, must make a better staple diet than the bread and milk we have seen solely given. This latter may be given in limited quantity, but the teeth and habits of the animal point to the necessity of a diet partly of seeds and nuts, avoiding, however, much hempseed, which is too oily to be used except in moderation. Dormice, again, should be kept in a roomy cage, where they can have space to jump from perch to perch—in fact their general management much resembles that of the squirrel. They much enjoy occasional liberty, when they will run up curtains and play about in a very attractive manner.

Dormice have sometimes bred in captivity, but it is rarely any are brought up. It is, in fact, rather difficult to procure a pair. Plenty of space, and several nest-boxes round the cage, hung on outside and entered by holes, so that the female can take her choice, are most likely to result in such a triumph for the owner. We have often thought that a bit of turf put in the cage every day, and a little water in a shallow vessel, would probably keep these animals in better health, especially at breeding time. The most extreme cleanliness is necessary at all times, but the mother must not be disturbed should she have young.

The *Common Rat* can be tamed without any particular difficulty, if desired, by a little judicious starvation. Leave them a couple of days without food, then give them some, and stand by for a while whether the rat eats or not. After a fair meal, starve for another day, and the chances are that when you go with food again the rat will be eager enough to welcome you. The matter will be still easier if you rub on your fingers a drop or two of oil of aniseed, of which both rats and mice are passionately fond. On the whole, however, the common rat is not a very handsome pet, and will sometimes bite when least expected. In some parts of England the generally extinct old *black rat* can still be found occasionally, and this animal is better worth keeping, both as a rarity and on account of its

milder disposition. We are inclined to think that the fancy (Fig. 85), or as we may almost call it, the *Domestic Rat*, is a descendant of this variety, as black is one of the colours known.

What we have called the *Domestic Rat* really deserves the name, being now a tame breed bred in captivity for many successive generations. It takes to petting quite naturally, and is a very intelligent animal, capable of being taught many tricks. The best known and most plentiful colour is white, with pink eyes like other albinos. There is also a black, really black all over, though the feet and belly are apt to go off grey or rusty: of course a really shiny black is much more valuable. Then there is a fawn or yellow; and occasionally greys are

Fig. 85.—FANCY RATS.

bred. From these colours patched rats have been bred, black and white being pretty common; and there is every probability that by crossing black, white, and yellow, using black and yellow most, and keeping the white blood down, true tortoiseshells might be bred, as they have been in fancy mice. A really perfect tortoiseshell rat would probably be worth ten to twenty shillings as a rarity, and we

do not believe there would be any great difficulty after the first careful mingling of the strains was done. The white rats can generally be bought for a shilling each, and enough can usually be sold at sixpence each to pay their way in food, &c. Yellows and blacks are generally dearer, but much depends on what happens to be bred in any particular neighbourhood. And this leads us to a remark that will apply to mice and some other animals as well. In keeping any creatures which multiply rapidly, but are not good for food, there will often be too many at times when there is no market among friends or at the shops (many shops will put a ticket in the window to say such and such pet animals are for sale). Now, remember, boys, this one thing—to neglect such little creatures because they are crowding and troublesome will not only bring disease and make your pets a nuisance, but is gross cruelty, while, on the other hand, to kill them mercifully and quickly is not cruelty: they have had, if well cared for, a happy life, and know nothing of the fate in store for them. To mere sentimental humanity it is hard to kill downright any living little creature, which may be the truest mercy; while the same sentimental people will perhaps, by mere neglect, cause the greatest suffering. So remember, boys, if you have to kill them, kill them quickly, and with a firm hand; but take constant and good care of all you keep alive.

A breeding-cage for a couple of rats (Fig. 86) should not be less than eighteen inches long and twelve from front to back; longer will not only be better for the rats, but will give you far more pleasure in watching their climbing and other antics. Remember that a rat is as comical and has as many queer tricks as a monkey, and in being able to see him well lies all the fun. Six inches of the cage must be partitioned off as a dark-box or nest, communicating by a round hole large enough for a rat to go in comfortably; the opposite or outer end, or else the top, must be made to open entirely, to clean out and renew the bedding. The rest of the cage must be fronted with wire, but should be covered at top, back, and end, remembering that rats are not fond of too much light. The wires may be five-eighths of an inch apart. At the bottom of the outer cage must be a sliding-floor or tray, which must be drawn out every day. It is best to paint it well, as it ought to be washed occasionally in water containing a little carbolic acid, as well as scraped clean every time. When replaced, strew over it pretty thickly fresh coarse pine sawdust—the reddish turpentine sort, or, if that cannot be had, the common kind, in which a few drops of turps have been kneaded up. If this is done, and the bedding changed every four or five days, there will be none of that smell so often complained of, and little trouble from vermin. For bedding there is the choice of hay, soft straw, coarse wadding, dry moss, and cowhair.

FIG. 86.—RAT CAGE.

The outer cage should have several perches, and a wire ladder or two and a swing will all be used to advantage. Near the back ends of the perches must be three tray-tins, projecting in from the outside, and fastened by a flange and button in the usual way. One of these will have the food, another milk occasionally, and the other water, which must always be supplied, as rats drink regularly. The cage must be in a rather sheltered and dry place.

We have not described the revolving cage, because it is totally unfit for either rats or mice. We have often seen the poor creatures with sore feet from this cause. Moreover, you only see them in this way taking one monotonous exercise, whereas by giving a roomy cage, and putting in perches, ladders, swings, &c.,

you see them doing all sorts of things. Give them a wheel as well if you like, so long as it is optional for them to use it without going into the nest. A great deal of ingenuity may be expended in fitting up the cage with all sorts of little dodges, which not only look pretty, but give pleasure to the rats, and show off their gymnastic powers. By cutting a lot of circles out of stiff card, snipping them all through as at A, and gumming them end to end with a little overlap as at B, then pulling the whole out, a spiral may be made (as in Fig. 87), which can

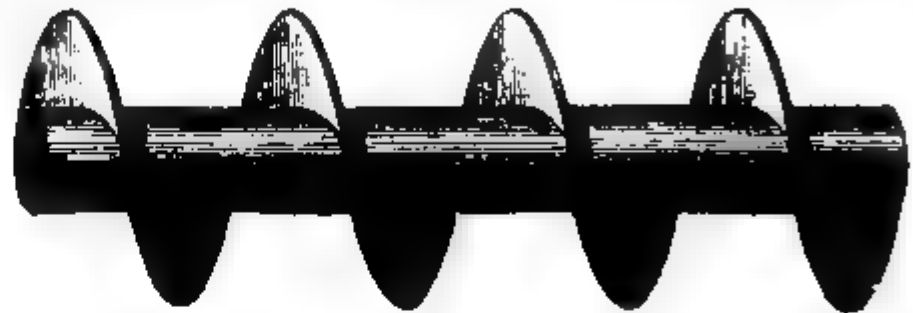


Fig. 87.—RAT STAIRCASE.

be fixed on a card tube, and set up vertically as a staircase in a wire tower. The rats will make good use of this piece of apparatus, especially if it opens into a wire turret higher than all the rest, from which they can look round.

The food should be rather varied. A little bread and milk, squeezed rather dry, may be given every day. When boiled rice is used for dinner, they may have a bit of that, or almost any other farinaceous dish; also bits of dry crust, canary-seed, millet, barley, wheat, or other seed, but do not give much hempseed at a time. A nut now and then is no harm, or a very little meat from the dinner-table, but much meat is bad. The food-tins must be kept rigorously clean; in fact, a double set is best, so that one may be kept in water. A little green food every couple of days—which they will not always eat, perhaps—is also well. By the way, it must not be forgotten that they are gnawing creatures, and *must* gnaw to keep their teeth the right length. For this reason there must be no edges of wood left about the cage, and the edges of the nest-hole need to be protected with thin zinc; but a piece of wood should always be kept in the cage for them to operate upon, and renewed when necessary.

Rats should not be allowed to breed under six months old, and relations should be avoided, which can be done by keeping up separate families, or exchanging. The easiest way to manage breeding is to put a male with two or three females for ten days, and then to put each female by herself into a smaller cage. But this is not always possible, on account of the number of cages; and several females will generally agree very well in one largish cage with a wire front, if separate little nests are fixed on outside, with an entrance-hole to each: each will *generally* choose and keep her nest. Two or three days after the male is gone, fresh hay should be placed in the nest, mixed with some cotton or wadding; and the compartment ought not to be disturbed afterwards till the young are a week old. The suckling mother, and the young ones when they come out, should have rather more bread and milk than usual.

Rats—at least the domestic kind—are usually very tame and affectionate when they once know their owner, which they soon do after feeding them a few times. They scarcely ever bite—we may say never, if fairly treated—unless a doe is handled when she has kindled, which ought never to be done. They may readily be taught many tricks, in which great help may be had from their great fondness for oil of rhodium, or oil of aniseed. Thus, if any small wooden article be smeared with a few drops, and put at the top of a rough pole, or such a staircase

as just now described, a rat will almost always bring it down, and in this way, rewarding each time with some little delicacy beside, they can readily be taught to bring down a little flag from the top of a flagstaff, and such things. Other tricks demand more patience; but it is well to let them run at liberty as often as possible, keeping them in better health and vigour.

Rats (and mice too) get "pot-belly" sometimes, like rabbits, if fed on bad or sour food. They sometimes get a sort of eruption like mange, which can generally be cured by anointing with glycerine containing a little sulphur. Sore feet are chiefly caused by the detestable wheel cages, which must be removed or fixed immovable, when a small quantity of zinc ointment will cure. They are, however, very little subject to disease of any kind. Fleas and lice will be unknown if sawdust is used as directed.

The tame or fancy mouse is even more hardy and prolific than the animals just described, if properly treated. The general management will be precisely the same, and a cage (Fig. 88) of the same general description, but smaller, will be the best. Mice do, however, quite as well if five or six females are kept with one male, provided sufficient nesting-places are made, which should be about three or four inches square. Four nest-places are generally enough for six females, as they often go two together; but it is as well to have six, or to make one or two larger. A very good plan is to have the nest-places at both ends of the cage, with the wired front in the middle; this plan keeps too strong a light off the cage, and mice are even fonder of darkness than rats. The same precautions must be taken as to a sliding bottom, and renewing bedding, except when a female has kindled, when her bed must not be disturbed for at least ten days after. The wires of a mouse-cage should not be over a quarter of an inch apart, or they will get through.

Fig. 88.—MOUSE CAGE.

Owing to their numbers, if bred largely, mice are rather apt to get infested with a sort of mite, very similar to the one which attacks the canary. For this reason it is absolutely necessary to have one or two spare cages, in order that each at intervals may be either scalded out with boiling carbolised water, or fumigated with sulphur or chlorine. In any case a wash with carbolised water will deodorize the cage, but it must not be inhabited again till perfectly dry. Only two tins are necessary, one for food, and the other for a drop of milk occasionally.

It does not answer to give the mouse quite such a variety of food as the rat will thrive upon. Every morning before breakfast give bread and milk squeezed rather dry. After breakfast take away that tin and soak it, and put in another with seeds, using oats, canary, millet, barley, and now and then a few grains of wheat. Only a grain or two of hempseed may be given now and then as a treat, but is too oily, as is linseed. This will last the rest of the day. A few blades of grass will often be eaten and do good, and in the winter a small morsel or two of sweet fat or suet, or a very little finely minced cooked meat, should be added twice a week. Avoid religiously sugar and salt, and, if you want the mice not to smell, bacon, cheese, and such things. The mice will not be the worse for a little of such things, but the mistress may! A few drops of milk or water should be given in the other tin—milk when any females have recently kindled, as it helps them to suckle. When the young come out, some crushed grits should be put in the seed-pan for a week or so with the other seeds. It is well to throw some

bran on the floor on top of the sawdust; they will eat some, which will tend to make bone and keep up the size, and the rest will absorb moisture, and give freer play to the smell of the sawdust. The cages must be kept in a well-sheltered, dry place; if warmish in the winter, all the better.

Fancy mice are most commonly white, which are most familiar of any, and can readily be made very tame. There are also black ones, but the black is rarely so rich as in rats. There are also fawns or yellows, which are larger than the others. We have also seen silver-greys, the colour of the chinchilla or silver-grey rabbit. By crossing and selection, piebalds are produced readily enough; and some of these, such as whites with black feet and ears, like the Himalayan rabbit, are very pretty. There are also blues, a kind of slaty lavender. By careful crossing true tortoiseshells have been produced, and these have been known to sell for as much as thirty shillings a pair; but there is much of luck about such a market, or any market.

The mouse goes twelve days with young. Breeding should not be allowed till three months old, and will continue in full swing till the doe is about two years old, or a little more. In that time, if unchecked, she may very likely have produced a hundred young ones.

Mice may be taught tricks in just the same way as rats. Little ladders and devices made of twine, and arranged in the cages, will be well used, and seldom gnawed if a piece of wood be fixed to give occupation to the teeth. In arranging the "mousery" care must of course be taken to exclude cats or other predatory animals; also rats and the common house mouse, which, if it can get to the fancy ones, will often attack and kill its weaker relatives.

SILKWORMS.

To keep silkworms for any time it is absolutely necessary to have a supply of mulberry leaves; that is, to be in the near neighbourhood of a mulberry tree, what sort does not matter. Silkworms *will* eat lettuce leaves if used from the first to that diet; but successive generations are found to dwindle away when thus fed, and the worms are also very subject to disease. They will not *thrive*, especially for more than one generation, upon other than their proper diet.

Eggs are readily obtainable by the ounce or the half-ounce, and often young people are glad to make a few pence by selling to acquaintances or people who hear of their stock, in which case it is almost always by number. They are sold adhering to pieces of paper, which should be placed in paper or cardboard trays in a warmish place, about the first of May, depending on the weather. In the sun is perhaps best, when the trays should be covered with gauze to protect the eggs from birds; but they may also be hatched on the mantle-piece over a kitchen fire. The eggs are yellow when first laid, but the fertile ones soon turn dark grey. When actual hatching approaches they get still darker, and a fresh and tender mulberry leaf should be placed under them at short intervals, so as to provide food in case any hatch before the next visit. As they hatch, they should be gently lifted into another cardboard tray by a slip of card or the end of a paper-knife, never taking them in the fingers.

The young worms are almost black, but gradually become, first grey, and then creamy white, growing very rapidly. About five weeks elapse from hatching until the worm is full grown and ready to spin, and during that time it casts its skin five times. Before each moult of this kind the silkworm appears torpid and ill, but when the skin is cast soon recommences eating with increased voracity.

Where silkworms are kept in any considerable numbers, it is usual with some cultivators to mince the mulberry leaves; a fresh supply of the minced leaves, cut fine on a chopping-board, being given every four to six hours. Others prefer to give simply fresh leaves, and this is at least best for silkworm rearing on a limited scale, as the old leaves and excrements can be readily removed. To avoid waste, some care should be taken to watch what quantity of leaf is really consumed, as fresh food must be supplied at the proper intervals, whether the old leaves be eaten or not. Another point to be taken care of is, that though the leaves be given fresh, they are *never wet*. Only young and tender leaves, again must be given to the newly hatched worms, which are unable to eat tough fibre; it may indeed be well to give some finely minced leaf to these for the first day or two, which may prevent many deaths; but older leaves may be given to the older worms. Minced leaves are most economical, as there are more fresh edges for the worms to bite; but unless some quantity is kept this is not material.

Lettuce-leaves must be freed from wet with particular care; but it is very difficult to rear any number successfully on this food.

The full-grown worm is from two inches and a half to three inches long. Most success will be obtained in a tolerably even, rather warm temperature, say 65° to 70°, though more than this is not injurious if there is plenty of air. Here we see why France and Italy are so much more suitable for this culture, damp being specially injurious. A parlour usually does well, if any place with light can be found for the worms. The dead leaves should be regularly cleared. The best way to avoid handling is to move the old leaf with the worms on it to one side of the tray, with a fresh leaf close by the side. At the next visit the old leaf will be found deserted, and may be removed.

After the last moult, the worms will eat heartily for ten days or so, when they will change to a transparent kind of colour. They are then about to spin, and soon become restless, wandering from the leaf to the sides of the tray, and raising their heads as if in search of something. They are in search of a good place to spin their cocoons, and this must be provided. Some people place small twigs against the sides of the trays; others make small conical screws of paper, and either place them in the trays or (when the caterpillars have quite finished eating) place the silkworms in them separately. Turnip-stalks are said to make good frames for cocoons, if placed rather open about the trays. The cocoons of the females are the largest. The silk will vary in colour, some cocoons being a very pure yellow, others ashy grey, and some almost a green tint.

Fig. 89—SILK-WINDER.

When many have been reared, only the finest cocoons of the two sexes should be selected for breeding, and the rest thrown into boiling water, which kills the unconscious chrysalis without pain. The finest are put into water at about 70° for winding the silk. A winder may be bought at almost any toy-shop, or easily made, according to the drawing (Fig. 89). The rough layer of coarse silk must first be stripped from the outside of the cocoons. With a little patience, or by stirring the cocoons in the water with a bunch of very small twigs or dry coarse grass, the ends of the good thread may be found, and several threads wound together. The chrysalis from each of the cocoons in the tepid water, when un-

covered, should be very gently placed in bran and just covered over with the same. The average length of a single silk thread is 400 yards, and the delicate fibre is very useful for many philosophical purposes and experiments. The quantity an amateur can produce is worth nothing commercially; but we have known young people, by the help of friends in the manufacturing trade, get a pair of gloves or stockings woven from their own silk. There is an interest in this, but it must be understood that it does not "pay."

The chrysalis lies torpid about twenty days, more or less, when the skin bursts in front and the perfect insect crawls out, in the shape of a very plain-looking, yellowish moth, the males being smaller and more slender than the females. A male and female should be provided for each other, and even pairs placed together and left to themselves on the trays, on a sheet of stiff paper. They eat no food in this state, and live a very short time, the female dying almost directly she has laid her eggs, and the male often before. The "good" eggs will turn ash-colour pretty soon, when many people dip the sheet to which they adhere in water, and then dry gradually. They should be kept in a moderately cool (but not cold) and dry place till the following year. One female will lay an average of say 350 eggs, and 200 moths about an ounce.

THE HEDGEHOG.

THIS is not, to say the truth, much of a pet, though he may be made very useful, being unequalled for ridding a house of beetles and cockroaches. He does, however, to some extent repay petting, for he always gets to know the one that feeds him, and will put down his bristles and allow himself to be stroked by that one at least, sometimes even licking the hand and making a queer attempt at play. This is not frequent, however, and on the whole the little animal is rather surly.

Hedgehogs often die when purchased for their beetle-killing propensities, for the simple reason that it is forgotten they are almost entirely carnivorous animals. At liberty they eat all kinds of animals, killing even rabbits occasionally; and they simply cannot live on the bread and milk usually given, and the cockroaches they catch. They want some meat, or to pick a bone besides, and will then thrive, if the bread and milk are given regularly. Besides cockroaches, they will attack rats and mice, and sometimes drive them away.

When first purchased hedgehogs are very wild, or, rather, shy, and after being fed will probably go off into some dark corner, only coming out when hungry; this gradually goes off with regular feeding. Some people say that if the animal is made drunk with whisky and water he becomes tame at once; and Dr. Ball says he tried the experiment with success. But patience, and confinement at first in some back kitchen, from which he cannot get out, with a corner in which to sleep on some hay, is a safer plan. We are sorry to have to say that the hedgehog is by no means a tidy animal; and this must be kept in mind. He is, however, undoubtedly effective in clearing a house of cockroaches.

TOADS AND TORTOISES.

Toads have been on several occasions partially tamed; we never yet heard of a frog being so, and should imagine that the latter's more aquatic habits interpose greater difficulties. In fact, even a toad is a difficult customer, not from any obstinacy in particular, but because taming with all animals mainly depends on feeding, and the toad has to be left at comparative liberty in the garden, and is

consequently much more independent. The food consists chiefly of insects, worms, slugs, &c., but little bits of meat, cheese, and even bread sometimes will be accepted. Certainly a tame toad demands a deal of trouble for very little, except the curiosity of the thing.

Tortoises are often kept, and to a certain extent become tame; but have not intelligence enough to show real attachment. One at Lambeth Palace was known to have lived there from 1633 to 1753, and was only killed then by being dug up in a frost. They bury themselves in the ground, or under manure or straw in the winter, coming out usually some time in April. They need no care or feeding, but to be turned into a garden where there are succulent plants such as lettuces or endive, where they will forage for themselves in summer and hibernate in winter. They might, no doubt, be kept in any small place if provided with some earth or soft material, and fed with the sort of greens rabbits eat, such as sow-thistles, dandelions, and other soft herbs.

THE AQUARIUM.

To describe all that may be done with an indoor Aquarium would require more than all the pages of this work, for the aquarium will furnish study and occupation for a lifetime. Some of the plants and animals that were first pressed into the service by the pioneers in this branch of natural history are still found most suitable for simple management; and we trust a few hints as to the objects and management best adapted for beginners may serve to introduce some of our readers to a most fascinating branch of natural history. The simplest form of all is, of course, the globe for

GOLD AND SILVER FISH.

These beautiful creatures are a Chinese production from the Carp family, but are now very common. They should be purchased at a respectable shop, and placed in a globe amply large enough (Fig. 90), not more than a couple being turned into a globe twelve inches across, and three-fourths filled with water; while three and four fish ought to have sixteen or eighteen inches. The fish should be healthy, which is only secured by purchasing at a respectable shop, and the globe should on no account be placed in the sun, or near a fire. A little clean duckweed should be placed in the globe, or some other aquatic plant, against which they will rub, and sometimes eat a small portion, and it will also help to keep up the supply of oxygen; it is also well to put a little washed gravel in the bottom of the globe. They are fed occasionally on very small particles of bread or biscuit thrown in the water; and as this need not be very often, and the water will need changing at least as often, it is well to give it before changing the water, in order that clean fresh water may be given soon after. This changing of the water at least once a week is very important; but beyond it, a glass syringe must be taken, and with it water squirted hard down into the globe every morning, for reasons given presently. In default of this, the fish will become sickly, and perhaps come up to the top for air, a sure sign that the air in the water is

Fig. 90.—GLOBE OF GOLD FISHES.

exhausted. This is the most frequent cause of the disease that often attacks these fish, the scales becoming dull and slimy. If taken in time, a vigorous oxygenation of the water will sometimes cure, but it is generally necessary to turn the diseased fish into a pond. In changing the water, it is best to remove the fish very carefully by hand, when the globe must be thoroughly rubbed clean. It is usually sufficient to change the water twice a week, and food may be given every day if eaten. The female fish will not spawn in a globe, and are very apt to sicken in the spawning season unless they can then be placed in a pond, where they breed freely.

THE FRESH-WATER AQUARIUM.

Many people would get on better with their aquariums if they did not try to make such a complete concern, and insist on having nothing but a tank of glass. It is not natural for any water creatures to have their abode surrounded by light on all sides; and if you notice the great public tanks, the glass through which you see them is turned to an almost dark hall, and the light comes from the top only. If you must have a glass tank, have a shallow one in proportion to its size, and get it at a respectable shop which can guarantee no poisonous cement has been used; if you are not sure about this, paint over the inside of the joints with shellac dissolved in alcohol, and after this is dry, let water stand in it for several days. It is better to have all sides but one of slate. But you will do better still, for many purposes, with earthenware troughs (Fig. 91), which can be got of all shapes and sizes, need no cement, and are cheap.

Fig. 91.—EARTHENWARE AQUARIUM.

There is another reason for this kind of fresh-water aquarium. Nearly all the creatures you can put in them are carnivorous, and you therefore want to keep a few selected kinds only together, where you can feed them properly; whereas if more are kept in a larger tank, the larger and fiercer will eat the others, and there will be no end of trouble, besides that regular labour in providing food which is inseparable from anything of the sort.

Aquarium economy is easily understood as to its general principle. Fishes and all creatures which do not come up to the top to breathe, breathe by absorbing through their gills or other organs the air contained in the water. Water well splashed about contains a good deal of air, while boiled water contains hardly any, and in the latter fish would die of suffocation. In fact, fish die even if their heads are kept persistently down a stream; it prevents enough water from passing through their gills. Now they use up the fresh air, or rather oxygen, from water, as we do from the air of a room, and it has to be renewed in one of two ways. First, plants absorb the carbonic acid formed in the living animals, assimilating the carbon and giving back the oxygen to the water; by careful watching little silvery bubbles may be seen sticking to a water-plant. Or, secondly, it may be done by driving air into the water again. This should be done anyhow, by squirting a few syringefuls from a glass syringe hard into each tank every morning; and generally if the inmates seem sluggish and ill-thriving, it is worth while trying an extra allowance of this treatment. Aërating the water alone will often improve matters wonderfully.

The plants are, however, necessary also to keep up a proper balance, and here comes in another difficulty. A portion of them will *decay* and thus corrupt the water, and on this decayed material a green scum of *confervee* will grow. Some of this is no detriment, but a great deal of it is, besides spoiling the sight of the aquarium; we therefore want a few snails or other molluscs, which live on such matter as this very scum, and so keep the water fairly clear. It will be seen that a proper balance in a small vessel is likely to be a rather ticklish business, and so it is. Many failures must occur at first, with most beginners at least; but by degrees these will be overcome and success will be attained.

Get your tank, then, of any sort, but shallow and not deep, and contrive so that a glass plate can be laid over the top with half an inch of clear space, so as to keep out dust and yet allow plenty of air (Fig. 92). The next thing is to *bed* it, and here lies a danger little suspected. We want no growth but what we know of. Get some clean sandy gravel, and, unless it contains them already, add to it about one-fourth of smallish pebbles. Wash this till the water is pretty clear, with any rockwork you wish to use, and then well *boil* the lot for at least an hour, after which pour off the water and wash once more with cold. With this *bed* your tank, previously rinsed the last thing, and never put in *anything* not alive, especially shells, without well boiling and washing first. Shells, however, look quite out of character in a fresh-water aquarium. Do not put in much—a couple of inches deep will serve all possible purposes—and do not overdo any rockwork business. A little rockwork, rising just above the water, is absolutely necessary for animals which, like newts, come up sometimes to rest; and you want a few chinks and crannies for retirement, but if there are too many you will hardly ever see anything. The water must be added very gently, or it will knock the sand all to pieces after you have settled it.

Fig. 92.—FRESHWATER AQUARIUM.

Now for the plants. At the shops you can buy all those commonly used; but it is seldom necessary, as there are several at command, one or other of which will do, or two or three sorts may be tried together. In fact, almost any plant will do that is found in tolerably clear ponds or ditches. Duckweed is an excellent plant; so is Frog-bit (*Hydrocharis morsus-ranæ*), Water-crowfoot (*Ranunculus aquatilis*), the well-known Valisneria (this was one of the first and most popular plants ever used, and may be recommended still), and the Water-thyme (*Anacharis alismastrum*), which so often chokes canals. But there is no need to be very particular: almost any healthy water-plant that is not too large for the particular tank you want it for will do. Some of them want their roots settling in the gravel; others, like duckweed, float at large.

A few small molluscs are enough for a fair-sized tank: if there are too many, they will devour the living plants. Any fresh-water snails with any kind of spiral or single shell will answer; but the few fresh-water bivalves are apt to die, and taint the water. In summer the green scum will increase, especially if the sun ever shines on the tank; at this season the molluscs must be helped a bit by rubbing off a lot of it with a piece of sponge tied to a stick. The object is to

keep the water pretty clear, and if this altogether fails, a great portion of it must be renewed from time to time, putting the fresh water in from a rose so as to aerate the tank thoroughly. As to the water itself, average hard spring-water is quite unsuitable, and will fail. River-water is best—next, clear pond-water; if neither can be had, rain-water collected in a butt with a cover to it.

As to the inmates, there must be in each tank a very careful assortment, and only three or four to each gallon, except of very small ones, such as insects. If a lot of all sorts are put in, in spite of all you can do the larger and fiercer will eat the others. Almost any of the smaller fish will do, but pike and sticklebacks must be kept by themselves, the pike devouring every other fish, and sticklebacks fighting furiously. The perch, it may be observed, can be tamed to take food from the hand. Sticklebacks are very interesting, because they build small nests to lay their eggs in. The smaller fishes may be mostly fed with insects, tiny bits of meat, and bread-crumbs. The others must have minnows and such-like occasionally; worms are also useful, and sometimes the only food that can be readily found. Small eels also look pretty, but large ones are too big for all but large tanks; they can be fed with shredded cooked meat, or dead fish or worms.

Frogs are unsuitable, but the two newts—one six or seven inches long, the other three or four—are to our mind about the prettiest and most interesting animals of all. They will sometimes climb out on the rock, and at others swim about, and their olive bodies and yellow bellies look very handsome. They are perfectly harmless, never biting as some people say; but on no account keep the larger and smaller together, or the smaller will be pretty certain to be eaten. They can be fed with worms generally, and any of the smaller aquatic insects may be put in with them to be eaten as required. Any fish in the same tank should be about the same size, or a trifle larger; but it is better to give no other company except insects of the innocent kind. There should be in a tank for newts rather a full supply of plants, including some with flat leaves, when you may see them breed in the spring, the female gluing each egg up in a fold of a leaf, which she doubles up with her hind feet.

Of aquatic insects, caddis-worms and all kinds of spiders are innocent to all but smaller insects still, and may be put in with safety as food for fish and other larger creatures. To be kept long they must be kept by themselves, and some of the small beetles and other insects, or larvæ, need an exception in their favour of a little mud on the bottom. The insects called Water-boatmen, known by the *single* oar-like leg projecting from each side of the body (not that there is but one leg, but the others are so much smaller), only preys upon smaller insects; these it eats, and with them it must be fed. Of the larger beetles, it is well to buy the first specimens at a shop, in order clearly to distinguish between two of the largest, which much resemble each other, but are very different in qualities. The *Hydrophilus piceus* is of the two the larger—an inch and a quarter long—and is black on the back and a downy kind of white on the belly. This lives much on vegetables, and only sometimes eats other insects; the larvæ, however, are very voracious, but may be fed on meat. Very different is the *Dyticus marginalis*. This is perceptibly smaller, more olive-green than black, and close observation shows a yellowish line round the thorax; if taken in hand, it pushes *backwards*, and pricks with the sharp points it has in its hind legs, and emits a nauseating smell; the pricks are quite innocent. The foot-joint of the fore legs of this insect has suckers like a cuttle-fish, the largest of which can be seen with the naked eye. This is the fiercest creature we know, and will kill even fishes; *one only* of either sort must be kept in one vessel (if two are placed there, one will kill and eat the other), and may be fed on other insects, worms, or raw meat. The larva is as fierce as the beetle, and breathes through the tail. All the water-beetles fly, and must therefore be kept in by glass covers.

To conclude, let us repeat our advice to keep only a few sorts together, with caution, and always watch the general state of the whole. If scum collects, clean it off, and perhaps add another mollusc; if the inmates look sluggish and poor as well, replace some of the water, and well aerate. See to a supply of small worms and insects as food; water-fleas, small larvæ, and such small fry may be given almost at discretion. They will be soon eaten if wanted, and if not will wait till they are; and take out any *large* dead or decaying things at once. If all goes right, and is well adjusted, only some rain-water now and then to supply loss by evaporation ought to be needed.

THE SEA-WATER AQUARIUM.

The same general remarks as to keeping a few things in small tanks—at least at first—apply to the sea-water aquarium, as does the remark that light going through the sides is not natural. If you like, have one glass side to your tank, but only one, and let that front the room, not the window. It is much the best, if possible, to start your jars or tanks with clear sea-water from the shore, and clean sea-beach gravel taken from under water, usually consisting of bright sand and small fragments of shell. For oxygenation we must, of course, have some of the seaweeds, and concerning these there is one general remark to make which will keep things pretty safe, though it is not an absolutely correct rule. It is, to avoid all dull olive-green, or brown, or red, or large seaweeds, and to choose only the smaller, bright green, purple, or bluish kinds. These must be veritably transplanted by chipping off or taking up a bit of the rock, or pebbles, to which they are attached, but see there is nothing *but* the seaweed attached—no tiny sponges or worms—or your water will soon be black. Let the plants stand two days, and if all is then clear proceed. The small periwinkles or sea-snails, or small limpets, will do the scavenging business, and keep the aquarium clear of scum.

Small fish adapted for salt water may, of course, be kept if desired; but most people prefer a few hermit-crabs and sea-anemones. The latter must either be taken by chipping off a bit of the rock to which they are attached, or detached carefully by sliding something under them. Just one edge can generally be lifted by the thumb-nail, and then a paper-knife will often do the rest, or a common knife, though the latter is liable to cut them a little, which however is not generally any serious harm. But having had occasion to use a great deal of mica for scientific purposes, we can strongly recommend a film of this, which can easily be cut round the edges, and split to any stiffness and shape desired. This is thin as paper or card, flat, smooth, and flexible, and “goes under” beautifully. The kinds of these creatures are almost countless, and the sorts found will vary according to the coast. The larger ones will devour crabs of considerable size, and anemones are, therefore, best kept by themselves. The common Beadlet is the most plentiful, and also one of the most hardy: we mean those lumps of coloured jelly that may be seen almost anywhere when the tide is out, of various colours.

Starfishes also must be kept by themselves, being very voracious. The hermit-crabs are combative, but not particularly dangerous, and may be kept along with fish or prawns; but the latter must not be kept along with the more active fish, or anemones, or starfish, which would prey upon them. A lobster forms rather an interesting inmate of a large tank, in which one or two flat fish, such as soles or skate, make very suitable companions. The common small Squid, which moves by ejecting water from tubes, and thus forces itself violently backwards, is also a lively and interesting inmate.

The great difficulty of a salt-water aquarium is *food*, it being almost impossible inland for any but large public establishments to provide such sustenance

as is furnished by the sea. Hence nearly all the inmates usually die in a few months, more or less, and have to be renewed. The anemones will live that time without food, but bread-crumbs and fragments of garden-worms, or small land-snails, may be tried; cooked meat in small morsels will be taken, but is thought to hasten mortality. Fish must be fed the same way, in default of better food; but crabs and lobsters may be kept in fair condition by meat, as may shrimps and prawns, if the meat be shredded fine. Crabs, by the way, want to crawl out of the water at times, and must therefore have some rock above the surface. The larger fish it is difficult to feed at all.

Near the shore it is different. There a supply of food can always be got by taking a bucket down to a pool, and with a net filling it with the small fry always to be found there—young fry, young shrimps, jumpers, sea-lice, and such-like. If enough of this be supplied from time to time, they will live in health till wanted, and then be devoured. They form the natural food, and an aquarium is easily supplied in such situations. Otherwise, the best possible must be done with what the larder and the garden will afford, as above suggested; and often things may thus be kept going till the yearly visit to the sea-side gives opportunity for a renewal.

Water is no difficulty. It is best to get it clear and fresh; but if not, or if fouled by accident, it can be *made*. The proper salts are sold mixed in packets by several houses, and can generally be got at any respectable shop dealing in such matters; but if not, this is the mixture—

Common salt	..	..	..	..	1,945 grains.
Sulphate of lime	..	..	..	..	101 "
Chloride of magnesium	..	..	..	..	2634 "
Epsom salts	..	..	..	..	166 "
Chloride of potassium	..	..	..	..	55 "
Chalk	..	..	..	..	6 "
Bromide of magnesium	..	..	..	..	3 "
Clear <i>spring</i> water	..	..	..	..	1 gallon.

Salt water is made in this way for vast establishments, and used with perfect success. As long as the aquarium keeps clear and healthy, it never wants changing, and should not be changed, but simply well aerated with the glass syringe every day, and evaporation supplied as often as noticed (making a mark on the tank to see the proper level) by clear *distilled* water, always administered either by the syringe or by dropping in, so as to carry air with it. Dust must be carefully excluded by a glass plate, as described for the fresh-water aquarium, and the sun must never be allowed to remain long on the tank together.

To sum up, with the opportunities of giving food and care which most boys have, we can hardly advise a marine aquarium far inland, and should advise the equally interesting fresh-water tank in such circumstances. But a few dishes or troughs should always be kept going whilst at the sea-side, and the inmates may easily be sustained for some months at home with very moderate care. Beyond that few readers of these pages will be able to go with salt water, and those desirous of setting up a marine aquarium on an elaborate scale will need more detailed instruction than we can here enter into.

IN-DOOR AMUSEMENTS.

ROUND OR PARLOUR GAMES.

It is certainly a matter of regret that the names of most of the good people to whom we are indebted for the introduction of our favourite old-fashioned Round Games are buried in obscurity, for they deserve, in our estimation at least, the name of benefactors quite as much as any great discoverer or inventor. What higher aim could they possibly have had in view than that of teaching people how to enjoy themselves? It has been said that in the world there are two great heaps, one of human happiness, and the other of human misery, and that we are all engaged the whole day through in taking a portion from one heap and carrying it to the other. Surely the portion carried from one heap to the other by the kind folk who have at various times furnished us with our amusements must by this time be one of considerable size, and in spite of their names being unknown to us, we will ever feel grateful to them for contributing so largely to our enjoyment of life. A long time ago it was observed of the English as a race that they took their pleasures sadly; but we will hope that henceforth the observation may be applicable to past generations only, and that *our readers at any rate* will resolve that when they play they will play heartily, just as when they work they will work heartily. To the really hearty players, therefore, we have great pleasure in handing our collection of Round Games.

ACTING PROVERBS.

In this game each player may take a part, or if thought preferable, the company may divide themselves into actors and spectators. The actors then each fix upon a proverb which is to be represented by every one of them individually. There is to be no connection between them in any way. Each one in turn has simply to act before the rest of the company the proverb he has selected. The first player might, for instance, come into the room holding a cup in his hand; then, by way of acting his proverb, he might repeatedly make an appearance of attempting to drink out of the cup, but of being prevented each time by the cup slipping out of his hands, thus in dumb show illustrating the proverb, "There's many a slip between the cup and the lip." The second might come into the room rolling a ball, a footstool, or anything else that would do to represent a stone. After rolling it about for some time he takes it up and examines it with astonishment, as if something were wanting that he expected to find on it, making it, perhaps, too plainly evident to the company that the proverb he is aiming to depict is the familiar one of "A rolling stone gathers no moss." If really good acting be thrown into this game, it may be made exceedingly interesting.

ACTING RHYMES.

A word is chosen by the company which is likely to have a good many other words rhyming with it.

The first player then begins by silently acting some word that will rhyme with the one chosen; as for instance, should the selected word be *flow*, the first

actor might imitate an archer, and pretend to be shooting with a bow and arrow, thus representing the word *bow*, or he might with an imaginary scythe cut the long grass (*mow*), or pretend to be on the water in a boat, and make use of imaginary oars (*row*). As each word is acted it should be guessed by the spectators before the next one is attempted.

ADJECTIVES.

A sheet of paper and a pencil are given to the players, upon which each is requested to write five or six adjectives. In the meantime one of the company undertakes to improvise a little story, or, which will do quite as well, is provided with some short narrative from a book.

The papers are then collected, and the story is read aloud, the reader of the same substituting for the original adjectives those supplied by the company on their papers, placing them, without any regard to sense, in the order in which they have been received.

The result will be something of this kind:—"The sweet heron is a bird of a hard shape, with a transparent head and an agitated bill set upon a hopeful neck. Its picturesque legs are put far back in its body, the feet and claws are false, and the tail very new-fangled. It is a durable distorted bird, unsophisticated in its movements, with a blind voice, and tender in its habits. In the mysterious days of falconry the places where the heron bred were counted almost shy, the bird was held to be serious game, and slight statutes were enacted for its preservation," and so on.

THE ADVENTURERS.

The great advantage to be derived from many of our most popular games is that they combine instruction with amusement. The game we are about to describe is one of this number, and will give the players the opportunity of exhibiting their geographical knowledge, as well as any knowledge they may have as to the physical condition, manufactures, and customs of the countries which, in imagination, they intend visiting.

The company must first of all fancy themselves to be a party of travellers bound for foreign lands.

A starting-place is fixed upon, from which point the first player sets out on his journey. In some cases maps are allowed, and certainly, if any one should be doubtful as to the accuracy of his ideas of locality, both for his own sake and that of his friends he will do wisely to have a map before him.

The first player then proceeds to inform the company what spot he means to visit, and what kind of conveyance he means to travel in; on arriving at the place what he means to buy, and on returning home which of his friends is to be favoured by having his purchase offered as a gift.

To do all this is not quite so easy as might at first be imagined. In the first place there must be some knowledge of the country to which the traveller is going; he must know the modes of conveyance, the preparations he will have to make, and the time that will be occupied during the journey.

Also, he must know something of the capabilities of the people whom he means to visit, because what he buys must be something that is manufactured by them, or that is an article of produce in their country. For instance, he must not go to North America for grapes, or to the warm and sunny South for furs. The presents, too, must be suitable for the persons to whom they are to be offered. A Japanese fan must not be offered to a wild schoolboy, or a meerschaum pipe to a young lady. Forfeits may be exacted for any mistakes of this kind, or, indeed, for mistakes of any description; the greater will be the fun if at the end of the game a good number of forfeits should have accumulated.

The second player must make his starting-point where his predecessor completed his travels, and may either cut across the country quickly, make his purchase, and return home again, or he may loiter on the road to sketch, botanise, or amuse himself in any other way.

It is astonishing how much pleasure may be derived by listening to the various experiences related, especially when a few of the company are gifted with vivid imaginations.

Sometimes rhyme is employed instead of prose for recounting the travels, and with very great success. When this is done the speaker may, if so inclined, end his description abruptly, thus leaving it to the next player about to commence his narrative to supply a line which shall rhyme with the one just uttered.

ÆSOP'S MISSION.

This being a game of mystery, it is, of course, necessary that it should be unknown to, at any rate, a few of the company—the more the better. One of the gentlemen well acquainted with the game undertakes to represent Æsop. In order to do so more effectually, he may put a cushion or pillow under his coat to imitate a hump, provide himself with a thick stick for a crutch, make a false nose, and put a patch over one eye. The rest of the company must then each assume the name of some subject of the animal kingdom—a bird, beast, or fish—and having done this must prepare themselves to listen to the words of their great master. Limping into their midst, Æsop then tells them that the wrath of the great god Jupiter has been aroused, and as the cause of a calamity so terrible must be that one or more of them have been committing some crime or other, he is anxious to discover without further delay who are the guilty subjects. "I shall therefore," continues he, "question you closely all round, and I shall expect you every one to give me truthful answers. To begin with you, Mr. Lion, as you are the king of beasts, I sincerely hope you have done nothing derogatory to your high position; still, as it is absolutely necessary that you should be examined with the rest of your friends, will you please tell me what food you have eaten lately?" Should the lion have eaten a lamb, a sheep, a tiger, a bear, or any other dainty that is spelt without the letter O, he is acquitted as innocent; but should he have eaten a leopard, a goose, a fox, or any other creature, in the name of which the letter O occurs, he is pronounced by Æsop to be deserving of punishment, and is therefore sentenced to pay a forfeit. The other animals in turn then undergo a similar examination, during which each one must remember that in naming their prey they must confine themselves to such food as is suited to the species they have adopted. The game may be carried on for any length of time, or until all have discovered the secret in it. There is no fear of the interest flagging, so long as even only one of the company is still left unable to solve the mystery.

ALPHABET GAMES.

Provided with a good boxful of letters, either on wood or cardboard, a clean table, a bright fire, and three or four pleasant companions, I have no hesitation in saying that a very pleasant hour may be spent. It is almost needless to give directions how to proceed with the letters, for they can be used in a variety of ways, according to inclination. Sometimes a word is formed by one person, the letters of which he passes on to his neighbour, asking him to find out what the word is. A still more interesting method is for the whole party to fix upon one long word, and all try in a certain time how many different words can be made of it. Or another way, even better still, is to shuffle the letters well together, and then to give to each person a certain number. All must then make a

sentence out of the letters, whether with or without sense, as best they can. The transposition of words, too, is very amusing, and can be done either with the loose letters or with pencil and paper.

The names of poets, authors, or great men famous in history may be given, the letters of which may be so completely altered as to form words or sentences totally different from the original.

For instance :—

We lads got on.
Rich able man.
Side Rail.
Pale Noon.

W. E. Gladstone.
Chamberlain.
Disraeli.
Napoleon.

THE ARTISTS' MENAGERIE.

A pencil and a piece of paper of moderately good size are given to the players, each of whom is requested to draw on the top of the sheet a head of some description, it may be a human head or that of any animal, either bird, beast, or

fish. As soon as each sketch is finished the paper must be folded back, and passed to the left-hand neighbour, no one on any account looking at the drawing under the fold. The body of something must next be drawn. As before, it may be either a human body or that of any animal, and the papers must then be again folded and passed to the left. Lastly, a pair of legs must be added, or it may be four legs, the number will depend upon the animal depicted. The productions all being complete, they are opened and passed round to the company, who will be edified by seeing before them some very

LEAVES FROM AN ARTIST'S SKETCH-BOOK.

ridiculous specimens of art—see our illustrations, for instance. The dotted lines in these figures show where the paper was folded back, as each "artist" finished his work.

THE BABY ELEPHANT.

A very good imitation of a Baby Elephant can easily be got up by two or three of the company, who are willing to spend a little time and trouble in making the necessary preparations. In the first place a large grey shawl or rug must be found, as closely resembling the colour of an elephant as possible. On this a couple of flaps of the same material must be sewn, to represent the ears, and also two pieces of marked paper for the eyes. No difficulty will be found in finding tusks, which may consist of cardboard or stiff white paper, rolled up tightly, while the trunk may be made of a piece of grey flannel also rolled up. The body of the dear little creature is then constructed by means of two performers, who stand one behind the other, each with his body bent down, so as to make the backs of both one long surface, the one in front holding the trunk, while the one behind holds the tusks one in each hand. The shawl is then thrown

over them both, when the result will be a figure very much resembling a little elephant. When all is complete, the services of a third performer should be enlisted to undertake the post of keeper to the elephant. If the person chosen for this capacity have great inventive faculties, the description given by him may be made to add greatly to the amusement of the scene.

THE BIRD-CATCHER.

One of the party is chosen to be the bird-catcher. The rest fix upon some particular bird whose voice they can imitate when called upon, the owl being the only bird forbidden to be chosen. Then sitting in order round the room with their hands on their knees, they listen to the story their master has to tell them. The Bird-catcher begins by relating some incident in which the feathered tribe take a very prominent position, but particularly those birds represented by the company. Each one, as the name of the bird he has chosen is mentioned, utters the cry peculiar to it, never for a moment moving his hands from his knees. Should the owl be referred to, however, every one is expected to place his hands behind him, and to keep them there until the name of another bird has been mentioned, when he must, as before, place them on his knees. During the moving of the hands, if the Bird-catcher can succeed in securing a hand, the owner of it must pay a forfeit, and also change places with the Bird-catcher.

We must not forget to observe that when the leader, or Bird-catcher, as he is called, refers in his narrative to "all the birds in the air," all the players are to utter at the same time the cries of the different birds they represent.

BLIND MAN'S BUFF.

A handkerchief must be tied over the eyes of some one of the party who has volunteered to be blind man; after which he is turned round three times, then let loose to catch any one he can. As soon as he has succeeded in laying hold of one of his friends, if able to say who it is he is liberated, and the handkerchief is transferred to the eyes of the newly-made captive, who in his turn becomes blind man. This position the new victim must hold until, like his predecessor, he shall succeed in catching some one, and naming correctly the person he has caught.

BLIND POSTMAN.

In this game the first thing to be done is to appoint a postmaster-general and a postman. The table must then be pushed on one side; so that when the company have arranged themselves round the room there may be plenty of room to move about. The postmaster-general, with paper and pencil in hand, then goes round the room, and writes down each person's name, linking with it the name of the town that the owner of the name chooses to represent. As soon as the towns are chosen, and all are in readiness, the postman is blindfolded and placed in the middle of the room. The postmaster then announces that a letter has been sent from one town to another, perhaps from London to Edinburgh. If so, the representatives of these two cities must stand up, and, as silently as possible, change seats. While the transition is being made, the postman is at liberty to secure one of the seats for himself. If he can do so, then the former occupant of the chair must submit to be blindfolded, and take upon himself the office of postman.

BLOWING OUT THE CANDLE.

No end of merriment has frequently been created by this simple, innocent game. It is equally interesting to old people and to little children, for in many cases those who have prided themselves on the accuracy of their calculating powers

and the clearness of their mental vision have found themselves utterly defeated in it. A lighted candle must be placed on a small table at one end of the room, with plenty of walking space left clear in front of it. One of the company is invited to blow out the flame blindfold. Should any one volunteer, he is placed exactly in front of the candle, while the bandage is being fastened on his eyes, and told to take three steps back, turn round three steps, then take three steps forward and blow out the light. No directions could sound more simple. The opinion that there is nothing in it has often been expressed by those who have never seen the thing done. Not many people, however, are able to manage it—the reason why, you young people will soon find out, if you decide to give the game a fair trial.

BOUTS RIMÉS.

Several rhyming games are given among these Round Games, and the following is simply a variety of some of them:—

A slip of paper is given to each player, who is requested to write in one corner of it two words that rhyme.

The papers are then collected and read aloud, after which every one is expected to write a short stanza, introducing all the rhymes that have been suggested.

When the completed poems are read aloud, it is very amusing to observe how totally different are the styles adopted by the various authors, and how great is the dissimilarity that exists between the ideas suggested by each one.

"BROTHER, I'M BOBBED."

Two chairs are placed in the middle of the room, upon one of which some one unacquainted with the game must be asked to take a seat. The other chair must be occupied by a lady or gentleman to whom the game is familiar. A large shawl or table-cloth is then put over the heads of both, so that nothing that is going on in the room can be visible to them. The person, however, who understands the game may stealthily pull away the cloth from his own head, keeping it round his shoulders only, so that his companion may have no suspicion that both are not equally blindfolded. The player acquainted with the game then with his slipper hits his own head, at the same time calling out, "Brother, I'm bobbed." His blind companion will then ask, "Who bobbed you?" upon which the first player must name some person in the room, as if making a guess in the matter. He will next hit the head of the player under the shawl with the slipper, who will also exclaim, "Brother, I'm bobbed." "Who bobbed you?" the first player will inquire. The blinded player may then guess which person in the room he suspects of having hit him. The fun of the whole affair lies in the fact that the bobbing, which the blind player suspects is performed by the various members of the company, is really chiefly done by the player sitting close beside him. Sometimes, too, the bobbing business is done so effectually, and with such force, as to render it anything but amusing to the poor blinded victim, although to the spectators it may be unmistakably so. Should the victim be a gentleman, a few sharp raps with a slipper will not make any material difference to him; but if instead it should happen to be a lady, the "bobbing" must be of the gentlest.

"BUFF SAYS 'BAFF.'"

In this game no one is allowed to either laugh or smile; consequently, it is generally one of the games chosen when the merriment of the evening has reached its highest pitch. The company seat themselves in a half circle at one end of the room, with the exception of one of their number, who is supposed to have gone on a visit to Buff. He then enters the room with the poker in his

hand, and his face looking as grave as possible. When he is asked by his friends in succession :—

"Where do you come from?"
 "From Buff."
 "Did he say anything to you?"
 "Buff said Buff,
 And gave me this staff,
 Telling me neither to smile nor laugh.
 Buff says Buff to all his men,
 And I say Buff to you again,
 And he neither laughs nor smiles,
 In spite of all your cunning wiles,
 But carries his face with a very good grace,
 And passes his stick to the very next place."

If all this can be repeated without laughing, the player is highly to be commended. He may then deliver up his staff to some one else, and take his seat.

BUFF WITH THE WAND.

Blind Man's Buff is so time-honoured and popular with young and old, that one would think it impossible to devise a better game of the kind. The newer game of Buff with the Wand, however, is thought by many to be superior to the long-established favourite. The blinded person, with a stick in his hand, is placed in the middle of the room. The remainder of the party form a ring by joining hands, and to the music of a merry tune which should be played on the piano they all dance round him. Occasionally the music should be made to stop suddenly, when the blind man takes the opportunity of lowering his wand upon one of the circle. The person thus made the victim is then required to take hold of the stick until his fate is decided. The blind man then makes any absurd noise he likes, either the cry of animals, or street cries, which the captured person must imitate, trying as much as possible to disguise his own natural voice. Should the blind man detect who holds the stick, and guess rightly, he is released from his post, the person who has been caught taking his place. If not, he must still keep the bandage on his eyes, and hope for better success next time.

CAPPING VERSES.

This game is not unlike one that is elsewhere described as "Mixed-up Poetry." Every one at the table is supplied with a sheet of paper and a pencil, at the top of which is written by each player a line of poetry either original or from memory. The paper must then be folded down so as to conceal what has been written, and passed on to the right; at the same time the neighbour to whom it is passed must be told what is the last word written in the concealed line. Every one must then write under the folded paper a line to rhyme with the line above, being ignorant, of course, of what it is. Thus the game is carried on, until the papers have gone once or twice round the circle, when they can be opened and read aloud.

CHARADES.

Although the acting of charades is by no means an amusement of very recent invention, it is one that may always be made so thoroughly attractive, according to the amount of originality displayed, that most young people, during an evening's entertainment, hail with glee the announcement that a charade is about to be acted. It is not necessary that anything great should be attempted in the way of dressing, scenery, or similar preparations, such as are almost indispensable to the performance of private theatricals. Nothing is needed beyond a

few old clothes, shawls, and hats, and a few good actors, or rather, a few clever, bright, intelligent young people, all willing to employ their best energies in contributing to the amusement of their friends. What ability they may possess as actors will soon become evident by the success or failure of the charade.

The word charade derives its name from the Italian word *Schiarare*—to unravel or to clear up. Suitable as the word may be in some instances, we cannot help thinking that in the majority of cases the acting of a charade has the effect of making the word chosen anything but clear; indeed, the object of the players generally is to make it as ambiguous as possible. As all players of round games know how charades are got up, it would be superfluous to give any elaborate instructions regarding them, though perhaps the following illustration may be useful.

WORD "GO-BANG," TO BE REPRESENTED IN THREE SCENES.

SCENE 1.—In which the word *Go* is to be introduced.

The curtain drawn aside. Miss Jenkyns is seen reclining on her drawing-room couch, with a weary look on her face and a book in her hand.

Enter Footman.

Footman (pulling his forelock).—"Please ma'am, I'm come to say I wish to give you notice; I can't stop here no longer!"

Lady.—"Why, James, how is this? What can have made you so unexpectedly come to this decision?"

James.—"Well, ma'am, you see I want to live where there are more carriage visitors. I have nothing at all to say against you, ma'am, or the place; but I want to better myself by seeing a little of 'igh life."

Lady.—"Then if you have no other reason for wanting to go, James, I fear we shall have to part, as I certainly can't arrange to receive carriage visitors simply for your benefit." (*Sinks languidly back on the couch and resumes her book. James retires.*)

Lady (to herself).—"How tiresome these servants are, to be sure, now I shall have the trouble of engaging a new footman. I really think no one with my delicate health had ever so much to do before." (*Rises and retires.*)

SCENE 2.—Bringing in the word *Bang*.

Old gentleman sitting in an arm-chair, a table by his side, on which medicine bottles and a gruel basin are placed, and his leg, thickly bandaged, resting on a chair.

Old Gent.—"Oh, this horrid pain! what shall I do? will no one come to help me? That stupid doctor has done me no good."

Enter Maid-servant.—"Please, sir, the doctor has come. Shall I tell him to come upstairs?"

Old Gent.—"Of course you must, and unless he is quick I shall die before he gets here. Oh dear! Oh dear!" (*Exit maid, banging the door after her.*)

Old Gent (shrieking out with pain).—"Oh, you cruel creature, how can you bang the door in that way, when even the slightest footstep on the floor is enough to make me wild? Quick, doctor, quick!" (*Here the maid again appears, holding the door open for the doctor.*)

Doctor (with a large case of instruments under his arm).—"Mr. Grumbleton, you appear to be very ill; can I do anything to relieve you? Let me feel your pulse."

Old Gent.—"Oh, my leg!"

Doctor.—"Your nerves are in a very excited state; you must have perfect quiet." (*Here the street door is heard to bang loudly, making the house shake.*)

Old Gent.—"Keep quiet, do you say! You might as well tell me to cut my leg off. There is no such thing as quiet in this house. That little good-for-nothing of a maid never comes into the room without shutting the door with a bang."

Doctor.—"Be calm, my dear friend, and I will order you a soothing mixture, and as I leave the house I will insist upon perfect quiet being maintained." (*Then rebandaging the gentleman's leg, and placing him comfortably in the arm-chair, the doctor retires.*)

SCENE 3.—Bringing in the whole word, *Go-bang*.

Inside a coffee-room. Two or three friends are seated with their coffee and pipes, when one who has just returned from foreign lands, begins relating some of his adventures.

Smith.—"Yes, my boys, glad as I am to get back to my own country, I should not like to be without the remembrance of all that I have witnessed in the far-off lands I have been visiting."

Brown.—"Yes, friend, you must have had a brave heart to face the thousand dangers to which no doubt you have been exposed. But though it's getting late, we must, before parting, hear one of your adventures. So proceed, comrade."

Smith.—"Well, it's not worth while beginning a long tale when there's not time to finish it, so I'll just sketch the sort of risk one often runs in the wilds of the backwoods. My mates and I had been out one day on a hunting expedition, when, returning home late at night, I unfortunately got left behind. The darkness was so great that my absence was not noticed, and before very long I found I had taken the wrong track. I came to this conclusion because I heard nothing but the tramp of my own horse's hoofs, when suddenly I felt that danger was at hand. Almost before I could put my thoughts into words, I felt something go bang close past my ear; then three Indians rushed upon me. Instead of feeling fear, a kind of supernatural strength took possession of me. I lifted my pistol and shot the man nearest to me, the next I felled; when, strange to say, the third man just at this moment turned round and fled. I suppose he heard the voices and footsteps of my friends, who were, at last, coming in search of me. At any rate he disappeared, when we all made the best of our way home, truly thankful that my life had been spared."

Jones.—"Well done, Smith! Next time we meet you must tell us of the many escapes you have had, and wonderful scenes you have witnessed in foreign parts."

The following, among other words, are suitable for charade acting:—

Adulation, Andrew, Arrowroot, Artichoke, Articulate; Bayonet, Bellman, Bondmaid, Bonfire, Bookworm, Bracelet, Bridewell, Brimstone, Brushwood; Cabin, Carpet, Castaway, Catacomb, Champaign, Chaplain, Checkmate, Childhood, Cowslip, Cupboard, Cutlet; Daybreak, Dovetail, Downfall, Dustman; Earrings, Earshot, Exciseman; Farewell, Footman; Grandchild; Harebell, Handiwork, Handsome, Hardship, Helpless, Highgate, Highwayman, Homesick, Hornbook; Illwill, Indigent, Indulgent, Inmate, Insight, Intent, Intimate; Jewel, Jonquil, Joyful; Kindred, Kneedeep; Label, Lawful, Leapyear, Life-like, Loophole, Loveknot; Madcap, Matchless, Milkmaid, Mistake, Misunderstand, Mohair, Moment, Moonstruck; Namesake, Necklace, Nightmare, Nightshade, Ninepin, Nutmeg; Orphanage, Outside, Oxeye; Padlock, Painful, Parsonage, Penmanship, Pilgrim, Pilot, Pinchbeck, Purchase; Quarto, Quicklime, Quicksand, Quickset, Quicksilver; Ragamuffin, Ringleader, Roundhead, Ruthful; Scarlet, Season, Sentinel, Sightless, Skipjack, Sluggard, Sofa, Solo, Somebody, Sonnet, Sparrerib, Sparkling, Spectacle, Speculate, Speedwell, Spinster, Starling, Statement, Stucco, Supplicate, Sweetmeat, Sweetheart; Tactic, Tartar, Tenant, Tendon, Tenor, Threshold, Ticktack, Tiresome, Toadstool, Token, Torment, Tractable, Triplet, Tunnel; Upright, Uproar; Vampire, Vanguard; Waistcoat, Watchful, Watchman, Waterfall, Wayward, Wedding, Wedlock, Welcome, Welfare, Wilful, Willow, Workmanship; Yokemate, Youthful.

CLAIRVOYANT.

In this game one of the company standing outside the room is, strange to say, able to describe what is passing inside. A dialogue such as would have to be carried on between the principal players will best describe the game, and show how it is to be played:—

"Do you quite remember how the room is furnished in which we are sitting?"

"I do."

"Do you remember the colour of the chairs?"

"I do."

"Do you know the ornaments on the mantelpiece?"

"I do."

"And the vase of flowers?"

"I do."

"The old china in the cabinet?"

"Yea."

"The stuffed birds?"

"Yea."

"You think there is nothing in the room that has escaped your notice?"

"Nothing."

"Then please tell me which article I am now touching."

"You are touching the vase of flowers."

The vase of flowers being the only object preceded by the word *and*, the clairvoyant knows that that is the object which will be touched. The fun of the game, of course, consists in puzzling those of the company to whom the secret is unknown.

THE COMIC CONCERT.

In this performance the company for the time imagine themselves to be a band of musicians. The leader of the band is supposed to furnish each of the performers with a different musical instrument. Consequently, a violin, a harp, a flute, an accordion, a piano, a jew's-harp, and anything else that would add to the noise, are all to be performed upon at the same time. Provided with an instrument of some description himself, the leader begins playing a tune on his imaginary violoncello, or whatever else it may be, imitating the real sound as well as he can both in action and voice. The others all do the same, the sight presented being, as may well be imagined, exceedingly ludicrous, and the noise almost deafening. In the midst of it, the leader quite unexpectedly stops playing, and makes an entire change in his attitude and tone of voice, substituting for his own instrument one belonging to some one else. As soon as he does this, the performer who has been thus unceremoniously deprived of his instrument takes that of his leader, and performs on it instead. Thus the game is continued, every one being expected to carefully watch the leader's actions, and to be prepared at any time for making a sudden change.

CONSEQUENCES.

The old-fashioned game of Consequences is so well known that there are doubtless few people who are not thoroughly acquainted with it. It is played in the following manner:—Each person is first provided with half a sheet of note paper and a lead pencil. The leader of the game then requests that (1) *one or more adjectives* may be written at the top of each paper by its owner, and that, having done so, the paper may be folded down about half an inch, so as to conceal what has been written. Every one then passes the paper to the right-hand neighbour, and proceeds to write on the sheet that has just been given him by his left-hand neighbour, (2) *the name of a gentleman*, again folding the paper down and passing it on to the right. Then (3) *one or more adjectives* are written; then (4) *a lady's name*; next (5) *where they met*; next (6) *what he gave her*; next (7) *what he said to her*; next (8) *what she said to him*; next (9) *the consequences*; and lastly (10) *what the world said about it*.

Every time anything is written the paper must be turned down and passed on to the right. As soon as every one has written what the world said the papers are collected, and the leader will edify the company by reading them all aloud. The result will be something of this kind, or perhaps something even more absurd may be produced—"The *happy energetic* (1) *Mr. Simpkins* (2) met the *modest* (3) *Miss Robinson* (4) in the *Thames Tunnel* (5). He gave her a *sly glance* (6), and said to her, '*Do you love the moon?*' (7). She replied, '*Not if I know it*' (8). The consequence was *they sang a duet* (9), and the world said, '*Wonders never cease*'" (10).

CONVEYANCES.

To do justice to this game it will be necessary for the players to call to mind all they have ever read or heard about the various modes of travelling in all the four quarters of the globe, because every little detail will be of use.

The business commences by one of the company announcing that he intends starting on a journey, when he is asked whether he will go by sea or by land. To which quarter of the globe? Will he go north, south, east, or west? and last of all—What conveyance does he intend to use?

After these four questions have been answered, the first player is called upon to name the spot he intends to visit.

Mountain travelling may be described, the many ingenious methods of which are so well known to visitors to Italy and Switzerland.

The wonderful railway up the Righi need not be forgotten; mule travelling, arm-chairs carried by porters, and the dangerous-looking ladders which the Swiss peasants mount and remount so fearlessly at all times of the year, in order to scale the awful precipices, will each be borne in mind. In the cold regions the sledges drawn by reindeer may be employed, or the Greenland dogs, not forgetting the tremendous skates, that have the appearance of small canoes, used by the Laplanders; and also the stilts, which are used by some of the poor French people who live in the west of their country. Indeed, it is amazing how many different methods of conveyance have been contrived at one time or another for the benefit of us human beings.

In Spain and other places there are the diligences; in Arabia the camels; in China the junks; in Venice the gondolas.

Then, to come home, we have balloons, bicycles, wheelbarrows, perambulators, and all kinds of carriages, so that no one need be long in deciding what mode of travelling he shall for the time adopt. As soon as the four questions have been answered, should the first player be unable to name what country he will visit he must pay a forfeit, and the opportunity is passed on to his neighbour.

This game may be made intensely amusing, as will be proved by trial; and at the same time a very great amount of instruction may be derived from it.

GRAMBO.

Two pieces of paper, unlike both in size and colour, are given to each person. On one of them a noun must be written, and on the other a question. Two gentlemen's hats must then be called for, into one of which the nouns must be dropped, and into the other the questions, and all well shuffled. The hats must then be handed round, until each person is supplied with a question and a noun. The thing now to be done is for each player to write an answer in rhyme to the question he finds written on the one paper, bringing in the noun written on the other paper.

Sometimes the questions and the nouns are so thoroughly inapplicable to each other that it is impossible to produce anything like sensible poetry. The player need not trouble about that, however, for the more nonsensical the rhyme the greater the fun. Sometimes players are fortunate enough to draw from the hats both noun and question that may be easily linked together. A question once drawn was—"Why do summer roses fade?" The noun drawn was butterfly, so that the following rhyme was easily concocted:—

"Summer roses fade away,
The reason why I cannot say,
Unless it be because they try
To cheat the pretty butterfly."

CROSS QUESTIONS AND CROOKED ANSWERS.

This is a pleasant game, that may be enjoyed while sitting in a circle round the fire. The person at either end, who is honoured by commencing the game, must, in a whisper, ask a question of the player sitting next to him, taking care to remember the answer he receives, and also the question he himself asked. The second player must then do likewise, and so on, until every one in the party has asked a question and received an answer. The last person, of course, being under the necessity of receiving the answer to his question from the first person. Every one must then say aloud what was the question put to him, and what was the answer he received to the question he asked—the two together, of course, making nothing but nonsense, something like the following:—

- Q. Who is your favourite author?
 A. Beans and Bacon.
 Q. Were you ever in love?
 A. Cricket, decidedly.
 Q. Are you an admirer of Oliver Cromwell?
 A. Mark Twain.
 Q. Why is a cow like an oyster?
 A. Many a time.

Another way of playing this game is for one person to stand outside the circle; then, when all the whispering is finished, to come forward and ask a question of each person, receiving for his replies the answers they all had given to the questions they asked each other. Or what is, perhaps, a still better plan, both questions and answers may be written on different coloured paper, and then, after being shuffled, may be read aloud by the leader of the game.

“CUPID IS COMING.”

In this game all the adverbs that can be thought of will need to be brought into requisition. Seated in order round the room, the first player begins by saying to his neighbour, “Cupid is coming.” The neighbour then says, “How is he coming?” To which the first player replies by naming an adverb beginning with the letter A. This little form of procedure is repeated by every player until every one in the room has mentioned an adverb beginning with A. Next time Cupid is declared to be coming Beautifully, Bashfully, Bountifully, &c.; then Capriciously, Cautiously, Carefully, and so on, until the whole of the alphabet has been gone through, by which time, no doubt, it will be thought desirable to select another game.

THE CUSHION DANCE.

A hassock is placed end upwards in the middle of the floor, round which the players form a circle with hands joined, having first divided themselves into two equal parts.

The adversaries, facing each other, begin business by dancing round the hassock a few times; then suddenly one side tries to pull the other forward, so as to force one of their number to touch the hassock, and to upset it.

The struggle that necessarily ensues is a source of great fun, causing as much or even more merriment to spectators of the scene than to the players themselves. At last, in spite of the utmost dexterity, down goes the hassock or cushion, whichever it may be; some one's foot is sure to touch it before very long, when the unfortunate individual is dismissed from the circle, and compelled to pay a forfeit.

The advantages that the gentlemen have over the ladies in this game are very

great; they can leap over the stool and avoid it times without number, while the ladies are continually impeded by their dresses. It generally happens that two gentlemen are left to keep up the struggle, which in most cases is a very prolonged one.

DEFINITIONS.

This game is not fit for very young children, but among older ones, who wish to enjoy a little quiet time together, it will suit their purpose admirably. On a little slip of paper each member of the party writes down a subject for definition. The slips are then handed to the leader, who reads the subjects aloud, while each person copies them on a piece of paper. Every one is then requested to give definitions, not only of his own word, but of all the others, the whole being read aloud when finished.

DUMB CRAMBO.

After dividing the company into two equal parts, one half leaves the room; in their absence the remaining players fix upon a verb, to be guessed by those who have gone out when they return. As soon as the word is chosen, those outside the room are told with what word it rhymes. A consultation ensues, when the absent ones come in and silently act the word they think may be the right one. Supposing the verb thought of should have rhymed with *Sell*, the others might come in and begin felling imaginary trees with imaginary hatchets, but on no account uttering a single syllable. If *Fell* were the right word, the spectators, on perceiving what the actors were attempting to do, would clap their hands, as a signal that the word had been discovered. But if *Tell* or any other word had been thought of, the spectators would begin to hiss loudly, which the actors would know indicated that they were wrong, and that nothing remained for them but to try again. The rule is that, while the acting is going on, the spectators as well as the actors should be speechless. Should any one make a remark, or even utter a single syllable, a forfeit must be paid.

DWARF.

Just as absurd and ridiculous as the representation of the Giant (elsewhere explained) is that of the Dwarf, and to those who have never before seen it performed the picture is certainly a most bewildering one. The wonderful phenomenon is produced in the following manner:—On a table in front of the company the dwarf makes his appearance, his feet being the hands of one of the two gentlemen who have undertaken to manage the affair. His head is the property of the same gentleman, while his hands belong to the other gentleman, who thrusts them over the shoulders of his companion to take the place of those that are being made to act as feet. Stockings and shoes are of course put on to these artificial feet, and the little figure is dressed up as well as can be managed, in order to hide the comical way in which the portions of the two individuals are united. For this purpose a child's pinafore will be found as suitable as anything else. A third person generally takes part in the proceedings as exhibitor, and comes forward to introduce his little friend, perhaps as Count Borowlaski, the Polish dwarf, who lived in the last century, and who was remarkable for his intelligence and wit. This little creature was never more than three feet high, although he lived to be quite old. He was also very highly accomplished: he could dance, and played on the guitar quite proficiently. Or he might be introduced as Nicholas Ferry, the famous French dwarf, who was so small that when he was taken to church to be christened his mother made a bed for him in her sabot, and so comfortable was he in it that for the first six months of his life it was made to serve as a cradle

for the little fellow. Sense or nonsense may of course be improvised on the spot, and made use of in order to render the exhibition a success.

THE ELEMENTS.

Seated round the room, one of the company holds in his hand a ball, round which should be fastened a string, so that it may be easily drawn back again. Sometimes a ball of worsted is used, when a yard or two is left unwound. The possessor of the ball then throws it first to one person then to another, naming at the time one of the elements; and each player as the ball touches him must, before ten can be counted, mention an inhabitant of that element. Should any one speak when fire is mentioned he must pay a forfeit.

THE FARMYARD.

If it were not understood that joking of all kinds is considered lawful in most game playing, we might be inclined to think that in this game of the Farmyard a little unfairness existed in one person being made so completely the laughing-stock of all the rest. Still, as "in war all things are fair," so it seems to be in amusements, most hearty players evidently being quite willing to be either the laughers or the laughed at. The master of the ceremony announces that he will whisper in the ear of each person the name of an animal which, at some signal from him, they must all imitate as loudly as possible. The fact is, however, that to one person only he gives the name of an animal, and that is the donkey; to every one else he gives the command to be perfectly silent. After waiting a short time, that all may be in readiness, he makes the expected signal, when, instead of a number of sounds, nothing is to be heard but a loud bray. It is needless to remark that this game is seldom called for a second time in one evening.

THE FEATHER.

A small flossy feather with very little stem must be procured. The players then draw their chairs in a circle as closely together as possible. One of the party begins the game by throwing the feather into the air as high as possible above the centre of the ring formed. The object of the game is to keep it from touching any one, as the player whom it touches must pay a forfeit; and it is impossible to imagine the excitement that can be produced by each player preventing the feather from alighting upon him. The game must be heartily played to be fully appreciated, not only by the real actors of the performance, but by the spectators of the scene. Indeed, so absurd generally is the picture presented, that it is difficult to say whether the players or the watchers have the most fun.

FINDING THE RING.

The principle of the following puzzle is very similar to that contained in "Think of a Number."

First of all a ring must be provided, after which you can request the company to put it upon some one's finger, adding at the same time that you will tell them who has it, and also upon which hand, and even upon which finger it shall have been placed.

The ring being deposited on a certain finger, you must then ask some one to make for you the necessary calculation.

Multiply the number of the person having the ring by 2; to that add 3. Multiply this by 5; then add 8 if the ring be on the right hand, or 9 if on the left. Then multiply by 10, and add the number of the finger (the thumb is 1); and, lastly, add 2.

Ask now for the result, from which subtract mentally 222, and the remainder will give the answer.

For instance, suppose the ring were put on the fourth person, on the left hand, and the first finger, remembering that the thumb counts 1.

The following is the kind of sum to be worked out:—

The number of the person multiplied by 2	...	...	...	8
Add 3 ...	...	...	...	11
Multiply by 5	...	...	...	55
Add 9 for the left hand	...	...	...	64
Multiply by 10	...	...	...	640
Add the number of the finger 2	...	...	...	642
Add 2 ...	...	...	...	644
Subtract ..				222
				422

Which result proves it to be, beginning at the right-hand figure, the second finger of the left hand of the fourth person.

When the number of the person wearing the ring is above 9, the remainder will stand in four figures instead of three; in that case the first two will indicate the person.

Like all games of mental calculation, the more quickly this is done the better.

FLYING.

To play this game well it is necessary that there should be a good spokesman in the company, who will find ample opportunity for his gift of eloquence.

Simple as the game may appear to be, it is one that is generally played with very great success.

Each member of the party wishing to take part in it must place the right hand upon the left arm.

The leader then intimates that in the discourse with which he intends to favour his friends, whenever he mentions a creature that can fly, every right hand is to be raised and fluttered in the air in imitation of a bird flying. At the mention of all animals that cannot fly, the hands remain stationary. It is, of course, needless to say that the leader will do his best to have the hands raised when other animals are mentioned as well as flying ones, in order that a good number of forfeits may be collected.

All being in readiness, he will begin in a style something like the following:—

“One lovely morning in June I sallied forth to take the air. The honey-suckle and roses were shedding a delicious perfume, the *butterflies* and *bees* were flitting from flower to flower, the *cuckoo's* note resounded through the groves, and the *lark's* sweet trill was heard overhead. It seemed, indeed, that all *the birds of the air* (here all hands must be raised) were vying with each other as to whose song should be the loudest and the sweetest, when,” &c.

Thus the game is carried on until as many forfeits as are deemed desirable have been extracted from the company.

FORFEITS.

As an evening spent in playing round games would be thought incomplete if at the end of it the forfeits were not redeemed, so our book of amusements would be sadly lacking in interest if a list of forfeits were not provided. Indeed, many young people think that the forfeits are greater fun than the games themselves, and that the best part of the evening begins when forfeit time arrives. Still,

although we will give a list of forfeits, it is by no means necessary that in the crying of them none but certain prescribed ones should be used. The person deputed to pronounce judgment on those of his friends who have had to pay the forfeits may either invent something on the spur of the moment, or make use of what he has seen in a book or may have stored in his memory. Originality in such cases is often the best, simply because the sentence is made to suit, or rather *not to suit*, the victim; and the object of course of all these forfeit penances is to make the performers of them look absurd. For those players, however, who in preference to anything new still feel inclined to adopt the well-known good old-fashioned forfeits, we will supply a list of as many as will meet ordinary requirements.

1. *Bite an inch off the poker.*—This is done by holding the poker the distance of an inch from the mouth, and performing an imaginary bite.

2. *Kiss the lady you love best without any one knowing it.*—To do this the gentleman must of course kiss all the ladies present, the one he most admires taking her turn among the rest.

3. *Lie down your full length on the floor, and rise with your arms folded the whole time.*

4. *Kneel to the wittiest, bow to the prettiest, and kiss the one you love best.*—These injunctions may, of course, be obeyed in the letter or in the spirit, just as the person redeeming the forfeit feels inclined to do.

5. *Put yourself through the keyhole.*—To do this the word "Yourself" is written upon a piece of paper, which is rolled up and passed through the keyhole.

6. *Sit upon the fire.*—The trick in this forfeit is like the last one. Upon a piece of paper the words, "The fire," are written, and then sat upon.

7. *Take one of your friends upstairs, and bring him down upon a feather.*—Any one acquainted with this forfeit is sure to choose the stoutest person in the room as his companion to the higher regions. On returning to the room the redeemer of the forfeit will be provided with a soft feather, covered with down, which he will formally present to his stout companion, obeying, therefore, the command to bring him down upon a feather.

8. *Kiss a book inside and outside without opening it.*—This is done by first kissing the book in the room, then taking it outside and kissing it there.

9. *Place a book, ornament, or any other very small article on the floor, so that no one in the room can possibly jump over it.*—The way this is done is to place the article close to the wall.

10. *Shake a sixpence off the forehead.*—It is astonishing how even the most acute player may be deceived by this sixpenny imposition. The presiding genius, holding in his fingers a sixpence, proceeds with an air of great importance to fasten the coin upon the forehead of the victim, by means of first wetting it, and then pressing it firmly just above the eyes. As soon as the coin is considered to be firmly fixed, he takes away his hands, and also the coin. The person operated upon is then told to shake the sixpence down to the floor, without any aid from his hands, and so strong generally is the impression made upon the mind of the victim that the sixpence is still on the forehead, that the shaking may be continued for several minutes before the deception be discovered.

11. *Put one hand where the other cannot touch it.*—This is done by merely holding the right elbow with the left hand.

12. *Kiss the candlestick.*—Request a young lady to hold a lighted candle, and then steal a kiss from her.

13. *Laugh in one corner of the room, sing in another, cry in another, and dance in another.*

14. *Leave the room with two legs, and return with six.*—To do this you must go out of the room, and come back bringing a chair with you.

15. *Put four chairs in a row, take off your boots, and jump over them.*—This task would no doubt appear rather formidable for a young lady to perform, until she is made to understand that it is not the chairs, but the boots, she is expected to jump over.

16. *Blow a candle out blindfold.*—This forfeit is very similar to the game, elsewhere described, of Blowing out the Candle; still, there is no reason why it should not take its place among the rest of the forfeits. The victim is blindfolded, turned round a few times, and then requested to blow out the light. When the performance is over, the owner of the forfeit will no doubt have well deserved to have his property returned to him, for if securely blindfolded the task will have been no easy one. Another way of blowing out the candle is to pass the flame rapidly backwards and forwards before the mouth of the player, who must try to blow it out as it passes, a method that is almost, if not quite, as difficult as the former one.

17. *The German bana.*—In this charming little musical entertainment, three or four of the company can at the same time redeem their forfeits. An imaginary musical instrument is given to each one—they themselves must have no choice in the matter—and upon these instruments they must perform as best they can.

18. *Ask a question, the answer to which cannot possibly be answered in the negative.*—The question, of course, is “What does y-e-s spell?”

19. *The Statue.*—The unfortunate individual doomed to redeem his forfeit by acting a statue must allow himself to be placed in one position after another by different members of the company, and thus remain stationary until permission is given him to alter it.

20. *The Sentence.*—A certain number of letters are given to the forfeit-payer, who must use each one in the order in which it is given him for the commencement of a word. All the words, when made, must then form a sentence—placing the words in their proper order exactly as the letters with which they begin were given.

21. *Comparisons.*—The gentleman or lady must compare some one in the room to some object or another, and must then explain in which way he or she resembles the object, and in which way differs from it. For instance, a gentleman may compare a lady to a rose, because they are both equally sweet; unlike the rose, however, the lady is of course, without a thorn.

22. *The Excluded Vowels.*—Pay five compliments to some lady in the room. In the first one the letter *a* must not occur, in the second the letter *e* must be absent, in the third there must be no *i*, in the fourth no *o*, and in the fifth no *u*.

23. *Kiss your own shadow.*—The most pleasant method of executing this command is to hold a lighted candle so that your shadow may fall on a young lady's face, when you must take the opportunity of snatching a kiss.

24. *Form a blind judgment.*—The person upon whom the sentence has been passed must be blindfolded. The company are then made to pass before him one by one, while he not only gives the name of each, but also his opinion concerning them.

Not unfrequently the victim has to remain blindfold a very long time, for even if the name should be guessed correctly, it is no easy matter to form a just estimate of character, and unless his ideas meet with the approbation of the company, his forfeit is withheld from him.

Great silence must be observed while the ordeal of examination is going on. No one should speak, and all should step as lightly as possible.

25. *Act the dummy.*—You must do whatever any of the company wish you to perform without speaking a single word,

26. *The telegraphic message.*—Send your lover's name by telegram to the other end of the room. To do this you must whisper the favoured name to the person sitting next to you, who will whisper it to his neighbour, and so on until every one has been made acquainted with it.

27. *Act the Prussian soldier.*—This penance is one that is generally performed only by gentlemen. The uniform assumed is usually a coat turned inside out, a hat made of a twisted newspaper, a bag of some description for a cartridge-box, and soot moustaches.

Holding a walking-stick in a military style, the penitent goes up to a lady, presents arms, and stamps three times with his feet.

Rising from her seat, the lady must accompany the gentleman to the opposite side of the room, then whisper in his ear the name of the gentleman for whom she has a special preference.

Without speaking the brave Prussian must march up to the favoured gentleman, and escort him across the room to the side of the lady who has avowed herself his admirer. The lady is, of course, saluted by the object of her choice, after which she is taken back to the seat she originally occupied. The soldier then, presenting arms, returns to the gentleman, who whispers in his ear a favoured lady's name, to whom he escorts her admirer. The proceeding is thus carried on, until some lady is good enough to acknowledge her preference for the soldier himself above all the other gentlemen, when, after saluting the lady, he is at liberty to lay aside his military dress, and return to his seat.

28. *"'Twas I."*—The victim in this case is unmistakably doomed to occupy a very humiliating position. He must go round the room, inquiring of each person what object he has seen lately that has particularly attracted his notice. The answer may be—a baby, a thief, a donkey; whatever it is, the unfortunate redeemer of the forfeit must remark—" 'Twas I."

29. *The acrostic.*—A word is given to you, the letters of which you must convert into the first letters of a double set of adjectives, one half expressing good qualities, the other half bad ones. When complete you may present both good and bad qualities to the person you most admire, as expressive of your estimate of his or her character. For instance, should the word given you be Conduct. If a gentleman, you might inform your lady that you consider her—

C areful.
O rderly.
N oble.
D elightful.
U seful.
C ompassionate.
T idy.

while at the same time you think her to be—

C aptious.
O bnoxious.
N iggardly.
D eceitful.
U ntidy.
C ross.
T ouchy.

30. *The three words.*—The names of three articles are given to you, when on the spur of the moment you must declare to what use you would put them if they were in your possession for the benefit of the lady you admire. Supposing the words to be, a penknife, a half-crown, and a piece of string, you might say:—"With the penknife I would slay every one who attempted to place any

barrier between us; with the half-crown I would pay the clergyman to perform the marriage ceremony; and with the string I would tie our first pudding."

31. *Make a perfect woman.*—To do this the player has to select from the ladies present the personal features and traits of character that he most admires in each, and imagine them combined in one individual. Although the task is by no means one of the easiest, it may be made the opportunity of paying delicate little compliments to several ladies at once.

32. *Show the spirit of contrary.*—The idea in this imposition is the same as in the game of contrary. Whatever the player is told to do, he must do just the contrary.

33. *Give good advice.*—Go round the room, and to every one of the company give a piece of good advice.

34. *Flattering speeches.*—This penance is usually given to a gentleman, though there is no reason why the ladies should always be exempted from its performance. Should it be a gentleman, however, he must make six, twelve, or as many flattering speeches as he is told to a certain lady, without once making use of the letter L. For instance, he may tell her she is handsome, perfect, good, wise, gracious, or anything else he may choose to say, only whatever adjective he makes use of must be spelt without the letter L.

35. *The deaf man.*—This cruel punishment consists in the penitent being made to stand in the middle of the room, acting the part of a deaf man. In the meantime the company invite him to do certain things, which they know will be very agreeable to him. To the first three invitations he must reply—"I am deaf; I can't hear." To the fourth invitation he must reply—"I can hear"; and, however disagreeable the task may be, he must hasten to perform it. It is needless to say the company generally contrive that the last invitation shall be anything but pleasant.

36. *Act the parrot.*—The player condemned to this penance must go round the room, saying to every one of the company—"If I were a parrot, what would you teach me to say?" No end of ridiculous things may be suggested, but the rule is that every answer shall be repeated by the parrot before putting another question.

37. *Make your will.*—The victim in this case is commanded to say what he will leave as a legacy to every one of his friends in the room. To one he may leave his black hair, to another his eyebrows, to another (perhaps a lady) his dress coat, to another his excellent common sense, to another his wit, and so on until every one in the room has been remembered.

38. *Spell Constantinople.*—This trick, as most people are aware, consists in calling out "No, no!" to the speller when he has got as far as the last syllable but one. Thus he begins:—"C-o-n con, s-t-a-n stan, t-i ti." Here voices are heard crying "No, no!" which interruption, unless the victim be prepared for it, may lead him to imagine that he has made a mistake.

39. *The natural historian.*—Go to the first player, and ask him to name his favourite animal. Whatever animal he may mention, you must imitate its cry as loudly as you can. You then ask the second player to do the same, and so on until you shall have imitated all the animals mentioned, or until the company shall declare that you deserve to have your forfeit returned to you.

40. *The blind dancers.*—Among players who are not anxious to prolong the ordeal of forfeit crying any longer than is necessary, the following method of redeeming several forfeits at once may be acceptable:—Eight victims are chosen to be blindfolded, and while in this condition are requested to go through the first figure of a quadrille.

41. *The cats' concert.*—This is another method of redeeming any number of forfeits at once. The players who have their forfeits to redeem are requested to

place themselves together in a group, when, at a given signal from the leader, they all begin to sing any tune they like. The effect, as may well be imagined, is far from soothing.

42. *Spelling backwards*.—Spell some long word, such as hydrostatics, &c., backwards.

GIANT.

The wonderful performance known as the Giant is accomplished by the united efforts of two gentlemen, one of whom takes his position on the shoulders of the other, sitting of course with one leg on each side of his companion's neck. Cloaks, rugs, or coats of any description are then arranged round the two figures in order to hide the real state of things, so that when the Giant makes his appearance nothing is to be seen but one huge figure. The lower gentleman who supports his friend is expected to do little more than patiently to carry his burden, though he may be called upon to exert himself a little in the way of dancing should the Giant feel so inclined. The talking and gesticulating business all devolves upon the gentleman perched aloft, who may wear a mask, paint his face, or do anything else of the kind, to avoid being identified by the company.

THE GIRAFFE.

A very good imitation of a Giraffe may be contrived, on the same principles as those adopted in constructing the Baby Elephant. Provided with an animal's head as nearly like that of a Giraffe as possible, no more difficulty need be feared. First of all, the head must be fastened to the end of a long stick. One of two performers must then hold the stick aloft while his companion, standing close behind, must place himself in a stooping position, so as to make the outline of his own person like that of the lower part of the Giraffe's body. The long stick will of course form the neck of the animal, and the first performer will form the front part of the body. A cloth is then pinned round the stick and round the bodies of the two performers, leaving the legs, of course, to represent the legs of the Giraffe. A rope tail must be stuck in by some means or other, and if cleverly managed, it is astonishing what an excellent imitation of the real animal can thus be manufactured.

THE GRAND MUFTI.

One person is appointed to have the dignity of Grand Mufti conferred upon him, which means that, whatever ridiculous action he may choose to perform, that is preceded by the words, "Thus says the Grand Mufti," every one else must follow his example. Nothing that he does, however, unaccompanied by these words, is to be regarded; he may laugh, sneeze, throw up his arms, or do anything else equally absurd, no one must imitate what he does, unless he has uttered the words, "Thus says the Grand Mufti." In order to lead the company astray, and that more forfeits may be paid, the Mufti will no doubt occasionally alter the order of the words, or change them in some way; but all must be on the alert, and remain perfectly silent and motionless, whatever the Mufti either says or does, unless he has been pleased in the first instance to utter the proper words in their right order.

HANDS.

In this game the company generally divides into two parts, half being players, while the rest do the work of guessing. A thimble is then produced by one of the party, or something equally small, that may be easily held in the hand. Seated by the side of the table the players begin passing on the article from hand to hand. When the working has been done sufficiently, the closed

hands are all placed on the table for the opponents sitting opposite to guess in succession whose hand holds the treasure. As soon as the hiding-place is discovered, the opposite side take their turn.

"HE CAN DO LITTLE WHO CAN'T DO THIS."

This simple game has been a puzzler to young people many and many a time. With a stick in the left hand the player thumps on the floor, at the same time saying, "He can do little who can't do this." Then, passing the stick into the right hand, he gives it to the next person, who, if unacquainted with the game, will, no doubt, thump with the right hand. Of course, it is most natural to use the right hand for everything, consequently few people suspect that the secret of the game lies in simply taking the stick with your right hand when it is passed to you, but knocking with your left.

HISS AND CLAP.

In this game the gentlemen are all requested to leave the room, when the ladies take their seats, leaving a vacant place on the right side of each one for the gentleman of her choice. Each gentleman in turn is then summoned, and asked to guess which lady he imagines has chosen him for her partner. Should he guess rightly he is allowed to take his seat by the lady who has chosen him, while the company loudly clap hands, in proof of their congratulations on his success; but should he guess wrongly, he will be only too glad to disappear from the scene, so loud will be the hisses of his friends.

"HOT BOILED BEANS."

In this game some small article is to be hidden, the player who has to find it being sent out of the room while the hiding is being effected. This being done, the invitation, "Hot Boiled Beans and Bacon, make haste and come to supper," is given, upon which the searcher returns to the room and begins to hunt for the hidden article. The progress of the player is usually announced by assuring him that he is "very cold," "cold," "warmer," "warm," "hot," "very hot," or "burning," according as he is far from or near to the article to be discovered.

HOT COCKLES.

A game not unlike Shadow Buff is that known by the peculiar title of Hot Cockles. A handkerchief is tied over the eyes of one of the company, who then lays his head on a chair, as if he were about to submit to the punishment of being beheaded, and places his hand on his back with the palm uppermost. Any of the party come behind him and give him a slap on his open hand, he in the meantime trying to discover whose hand it is that strikes.

HOUSE FURNISHERS.

In this game the company are to imagine themselves a number of hosts and hostesses who are expecting the arrival of some friends, for whose reception they are totally unprepared, as far as provisions and household arrangements are concerned. Accordingly, each one must volunteer to set out immediately, in order to procure some particular article. First of all, the rooms must be furnished with tables, chairs, beds, bedsteads, curtains, carpets, and fire-irons; then knives, forks, and crockery of every kind must be obtained; and lastly, a good supply of provisions—meat, wine, ale, fruit, vegetables, sugar, coffee, tea—indeed, everything that would conduce to the comfort of the coming visitors. Every made article must come direct from the place where it has been manufactured, as must also the articles of produce from their native soil.

"HOW DO YOU LIKE YOUR NEIGHBOUR?"

The company must seat themselves round the room, leaving plenty of space in the middle for passing to and fro. One person left standing then begins the game by putting the question, "How do you like your neighbour?" to any one he pleases. The answer must be either "Not at all" or "Very much." Should the reply be "Not at all," the lady or gentleman is requested to say what other two members of the company would be preferred instead as neighbours, when the new neighbours and the old must immediately change places. During the transition the questioner may endeavour to secure a seat for himself, leaving out one of the four who have been struggling for seats to take the place of questioner. When the reply "Very much" is given, every one in the room must change places. The questioner, therefore, will easily find a seat for himself, and the person left standing must take his place as interrogator.

"HOW, WHEN, AND WHERE?"

In this game, as in others, a word is chosen by the company, containing as many meanings as possible, the person who has volunteered to be the questioner having previously gone out of the room. On being recalled, the person who has been out begins by asking each of his friends how they like it.

Supposing the word "cord" to have been chosen, the first player might answer *slight*, the next *sweet*, meaning *chord*, the next *loud*, the next *strong*, and so on until all have said *how* they liked it. The questioner then recommences his interrogations at the first player by inquiring "When do you like it?" Replies to this question something like the following may be given:—"When I am preparing to take a journey;" "When I am in church;" "When I am driving;" "When I feel musical." Then to the last question—"Where do you like it?" the company may reply—"In a piano;" "In the garden;" "Not round my neck;" "Always at hand," &c. No doubt long before all the questions have been answered the word that has been chosen will have been discovered.

HUNT THE RING.

The game of Hunt the Ring is perhaps better liked than Hunt the Slipper, on account of its being in the estimation of most people more convenient and manageable. Either a ring or a small key may be used for the purpose. Whichever it is, a string must be passed through it, and the ends fastened in a knot, forming thus a circular band. The company then stand in a circle, allowing the string to pass through the hands of each person, and enabling every one to slide the ring easily along from one to the other. The object of the player standing inside the circle is to stop it in its progress, which, in most cases, he finds a rather difficult task. The game is also frequently played without any string, when every one tries, of course, to pass the ring round very rapidly, without being detected by the hunter.

HUNT THE SLIPPER.

This surely must be one of our oldest games, and one, no doubt, that our grandmothers and grandfathers played at when they were children. The players all seat themselves, like so many tailors, on the floor in a ring, so that their toes all meet. A slipper (the smaller the better) is then produced, and given by the person outside to one sitting in the circle, with instructions that it must be mended by a certain day. Finding it not finished at the time appointed, the pretended owner declares that he must have it as it is, and thereupon commences the hunt. How it is carried on is no doubt too well known to need further explanation.

HUNT THE WHISTLE.

This game is always successful, and a source of very great amusement if only some one ignorant of the secret can be found who will volunteer to act as hunter. Such person is first requested to kneel down while some lady goes through the ceremony of conferring upon him the order of knighthood. During the process, the whistle, attached to a piece of ribbon, is pinned to the coat of the newly-made knight. He is then told to rise and go in quest of the whistle, which is in the possession of one of the party. The hunt now begins, the players all trying to deceive their victim in every way imaginable, and to make him think that they are passing the whistle from one to another. On every possible occasion, of course, the whistle should be sounded, until the deluded knight has made the discovery that the object of his search is fastened to himself.

"I APPRENTICED MY SON."

The shortest way of describing this game will be to give an illustration of the manner in which it is played. John: "I apprenticed my son to a grocer, and the first thing he sold was half-a-pound of C."

Nellie : Coffee?—No.

Sam : Cocoa?—No.

Tom : Cayenne Pepper?—No.

Edith : Chicory?—Yes.

Edith being the guesser of the right article, is entitled to be the next to apprentice her son. One guess only in turn is allowed to each player.

"I LOVE MY LOVE."

"I Love my Love" is played alphabetically, like "Cupid is Coming," though more ingenuity is required in it, simply because a number of words, instead of one adverb only, have quickly to be conjured up. In order to show clearly how the game is played, we will imagine ourselves to be the first of the players, who would have to proceed in a manner something like the following:—"I love my love with an 'A,' because she is amiable; I hate her with an 'A,' because she is arrogant. I took her to the sign of the Angel, and treated her to Apples and Apricots. Her name is Annie, and she comes from Australia." The next player takes "B," the next "C," and so on, until the whole of the alphabet has been gone through.

This simple game must be one of no recent invention if the tale be true told by Mr. Foote, the celebrated wit. He narrates that one day the Ladies Cheere, Fielding, and Hill were amusing themselves by playing at the children's game of "I love my love." Lady Cheere began by saying, "I love my love with an N, because he is a 'Night'" (Knight); Lady Fielding followed with, "I love my love with a G, because he is a 'Gustus'" (Justice); and Lady Hill added, "I love my love with an F, because he is a 'Fizishun'" (Physician). So much for the spelling powers of the ladies in the olden times.

"JACK'S ALIVE."

No one at all inclined to be slow in his movements need offer to take part in the game of "Jack's Alive," for quickness and promptitude of action are indispensable to its success. A piece of paper, or, better still, a long piece of firewood, is put into the fire until it is in a blazing condition when taken out. The first player, blowing out the flame, passes it to his neighbour, saying, "Jack's alive." It is then passed on to the next, and to all the

company in succession, each one trying to get rid of it before the spark has died out. Every one to whom it is offered must take it immediately the words "Jack's alive" are uttered, or a forfeit must be paid; and the one in whose hands Jack really expires must produce a forfeit. In some cases boys have actually been known, when playing at this game, to improve each other's appearance by marking black moustaches and eyebrows, &c.; but as such proceedings have nothing whatever to do with the real "Jack's Alive," we feel sure that none of our readers will ever practise this foolish habit.

THE JOLLY MILLER

The Jolly Miller is a game that may be played either in the open air or in the drawing-room, therefore it may be allowed to take its place among the list of round games. Not being generally considered, however, one of the most refined of recreations, a good large empty room, or a servants' hall, will be quite as suitable for its performance as the drawing-room. Each gentleman chooses a lady for a partner, excepting one who may be kind enough to volunteer to be the miller. This solitary one takes his stand in the middle of the room, while his companions in couples arm in arm walk round him singing the following lines:—

" There was a jolly miller who lived by himself.
As the wheel went round he made his wealth;
One hand in the copper and the other in the bag,
As the wheel went round he made his grab."

At the word "grab" every one must change partners, and while the transition is going on the miller has the opportunity given him of securing for himself one of the ladies. Should he succeed in doing so, the one necessarily left without a partner must take the place of the Jolly Miller, when he, like his predecessor, must occupy his lonely position until he is fortunate enough to steal a young lady from one of his friends.

JUDGE AND JURY.

The first thing to be done in this game is to select a judge and three jurymen. A piece of paper is then given to each of the remaining company, who, after due consideration, must write down the name of some one in history, the incidents of whose life they recollect sufficiently to be able to narrate. All having made their selection, the papers are presented to the judge, who calls upon one after another to submit to an examination. Supposing the first player to have chosen Guy Fawkes, he would be asked in what year he was born, in whose reign, to what country he belonged, what he did to make himself remarkable, what great men were his contemporaries, and anything else that might occur to the judge. No one, of course, with a superficial knowledge of history should accept the position of judge, nor yet that of jurymen. If agreeable to the company, living characters may be personified, still historical ones are generally the most interesting, and it is astonishing how much instruction as well as real amusement may be drawn from the game.

THE MAGIC ANSWER.

It is necessary that this game should be understood by two of the company who mean to take the lead in it, and that an agreement should be made between them as to what course to pursue. One of these leaders goes out of the room while the rest of the company choose a word for him to guess on his return. The agreement made is that the word thought of shall be named immediately after the mention of anything with four legs. Therefore the conversation

carried on between the two actors in the ceremony would be something like the following :—

- Q. "Was the word thought of a tree?"
 A. "No."
 Q. "Was it a book?"
 A. "No."
 Q. "Was it a canary?"
 A. "No."
 Q. "Was it the Queen?"
 A. "No."
 Q. "Was it a river?"
 A. "No."
 Q. "Was it a rabbit?"
 A. "No."
 Q. "Was it a purse?"
 A. "Yes."

MAGICAL MUSIC.

This is a game in which music is made to take a prominent part. On one of the company volunteering to leave the room, some particular article agreed upon is hidden. On being recalled, the person, ignorant of the hiding-place, must commence a diligent search, taking the piano as his guide. The loud tones will mean that he is very near the object of his search, and the soft tones that he is far from it. Another method of playing the same game is for the person who has been out of the room to try to discover on his return what the remainder of the company desire him to do. It may be to pick up something from the floor, to take off his coat, to look at himself in the glass, or anything else as absurd. The only clue afforded him of solving the riddle must be the loud or soft tones of the music.

THE MAGIC HATS.

Though the following trick cannot exactly be designated a Round Game, it may be performed by one of the company with great success during an interval of rest from playing. The performer begins by placing his own hat, along with another which he has borrowed, on the table, crown upwards. He then requests that the sugar-basin may be produced, from which on its arrival a lump is selected and given to him. Taking it in his fingers he promises, by some wonderful process, that he will swallow the sugar, and then, within a very short time, will let its position be under one of the two hats on the table, the company may decide which hat it shall be. It is generally suspected that a second lump of sugar will be taken from the basin, if it can be done without observation, consequently all eyes are fixed upon it. Instead of that, after swallowing the sugar the performer places the selected hat upon his own head, thus, of course, fulfilling his undertaking.

THE MAGIC WAND.

This being a game of mystery, there is not only a peculiar charm attached to it on that account, but it can also be made exceedingly attractive by the voluntary artistic movements of the performer. As in the Resting Wand, not only the leader must understand the game, but one of the company also must be in league with him, so that the two may understand each other, and work together. The person thus acting with the leader announces to the company that he will retire while a word is fixed upon, to be written on the floor when he returns by means of the magic wand. This done, a word is chosen, the person who retired is summoned, and the performance commences. The leader then begins by flourishing his wand in the air, and imitating as much as possible the tricks of a conjurer. He also makes an appearance of

writing on the floor, at the same time speaking to his friend in short sentences. The letter at the beginning of the first sentence must be the first consonant of the word that has been chosen by the company, the second consonant must be at the beginning of the second sentence, and so on; the vowels occurring between being expressed by thumps on the floor with the wand. "A" is expressed by one thump, "E" by two thumps, "I" by three, "O" by four, and "U" by five thumps. One good decided thump at the end signifies that the word is complete.

An illustration will, perhaps, best explain our meaning. We will suppose the word *Christmas* to have been chosen. If so, the performer might first begin by waving his stick aloft, then he must commence writing, as if with great care, on the ground, at the same time remarking, "Come quickly, fellow-worker, and prepare for thy duty." Here must be a slight pause, followed by the second sentence. "How difficult thy task will be, I dare not tell." Another pause, then the third sentence. "Remember, nothing can be really well done without labour." We have now got C H R. *I* being the next letter, is represented by three loud thumps with the stick. The conjurer here, assuming a puzzled air, might observe, "Surely we shall not be baffled." A pause, and then, "Trust me, I will help all I can." After another pause, "Mark my wand with care." The letter *A* coming now, one good thump is given on the floor; then, with the words "Speak quickly, friend, say the word," followed by one good thump, the mysterious business is concluded, the accomplice, no doubt, easily detecting that *Christmas* was the word chosen.

"THE MINISTER'S CAT."

This is a game that is played alphabetically, in a manner somewhat resembling "Cupid is Coming" and "I love my Love." The first player begins by saying, "The minister's cat" is an "ambitious cat," the next an "artful cat," and so on, until all have named an adjective beginning with A. The next time of going round the adjectives must begin with B, the next time C, and so on until the whole of the alphabet has been gone through.

MIXED-UP POETRY.

A great amount of fun may be obtained from this game of mixing up poetry, which is nothing more than selecting lines from different authors, and arranging them so as to make rhyme. The specimen below, prepared by Kitty Carrol, will illustrate our meaning:—

There was a sound of revelry by night,
Away down south where I was born;
Let dogs delight to bark and bite,
Cows in the meadow and sheep in the corn.

A chieftain to the Highlands bound,
His father's hope, his mother's joy,
Found something smooth and hard and round,
John Brown's little Indian boy.

Man wants but little here below,
Oats, peas, beans, and barley;
This world is all a fleeting show,
Over the water to Charley.

There is a calm for those who weep
In famous London town.

Little Bo Peep she lost her sheep—
The bark that held a prince went down.

John Gilpin was a citizen
From India's coral strand;
Far from the busy haunts of men
There is a happy land.

Hark from the tombs a doleful sound;
Dear, dear, what can the matter be?
Shake the forum round and round,
Come to the sunset tree.

MUSICAL CHAIRS.

It is no use attempting to play this game in anything but a good-sized room; and, if possible, chairs that may be easily moved and not soon broken should be chosen. Supposing there are fifteen players, fourteen chairs must be placed in the middle of the room, every alternate one having the seat the same way, and upon these the players must seat themselves. One person, therefore, is left standing. The music then begins, when the owners of the seats all march round until the music stops, which it is generally made to do unexpectedly; at this instant each person tries to secure a chair. Necessarily one player is left without a seat; he is considered *out*, and, in addition, he must pay a forfeit. One of the chairs is then taken away, and the game proceeds, a chair being removed every time the music stops. One unfortunate person is always left out in the cold, until at last one chair is struggled for by the two remaining players, and the successful one of these is considered to have earned the right to pronounce judgment on such as have had to pay forfeits.

"MY MASTER HAS SENT ME UNTO YOU."

No better game than this can be chosen by those who are partial to a little gentle exercise. Sitting in order round the room, the first player begins by saying to his neighbour, "My master has sent me unto you," at the same time working away with the right hand as if hammering on his knee. The person to whom this remark is made must reply "What to do?" In answer to which the first player says, "To work with one as I do." The second player, then working in the same way, must turn to his neighbour on the left, and carry on the same conversation with him, and so on, until every one in the room is working away with the right hand. The second time of going round the order is given to work with two hands; after that with one foot as well, then with two feet, and last of all with the head. Should any one be detected not keeping feet, hands, and head in constant motion while the game is going on, a forfeit can be demanded.

NOUNS AND QUESTIONS.

See "Crambo."

THE OBJECT GAME.

The party first divides itself into two equal parts. One person from each side is chosen to go out of the room, and, after consulting together, they fix upon any object they like for the rest to guess. The company then seat themselves in two distinct circles, sufficiently apart to prevent the remarks made in one circle from being overheard by those in the other. The two representatives are now summoned, and requested to take their places, one in each group, when a race begins as to which group shall first find out what object of thought has been fixed upon. The rule is that the number of questions asked

should be limited to twenty, though in many cases it is impossible to adhere to this restriction; while, on the other hand, the object is frequently guessed before the whole twenty questions have been asked. No restriction is placed upon the objects to be thought of—a drop of water, a ray of light, a crab's claw, a nail in the boot of some great man, or anything else may be chosen. The object of the game is, of course, to make the guessing as difficult as possible, so that the struggle as to who shall be the winners may be a hard one.

THE OLD SOLDIER.

The game of Old Soldier, though unmistakably an old one, is always welcome, especially to the little people. One of the company stands up and personifies for the time the character of an old soldier, who is destitute, ragged, and hungry. He goes round the room asking each one in turn for relief, the rule being that in the answers given to him the words "Yes," "No," "Black," or "White" must not be mentioned, neither must any hesitation be allowed. Want of promptness in a reply must be atoned for by the payment of a forfeit, just as much as would the mention of one of the forbidden words.

ORANGES AND LEMONS.

Two of the company, one supposed to be an Englishman and the other a Frenchman, stand face to face, holding each other's hands so as to form a kind of bridge for the rest to pass under one by one. As the company pass under the bridge, the couple holding hands sing the following well-known rhyme:—

"Oranges and Lemons,
Say the bells of St. Clement's.
You owe me five farthings,
Say the bells of St. Martin's.
When will you pay me?
Say the bells of Old Bailey.
When I grow rich,
Say the bells of Shoreditch.
When will that be?
Say the bells of Stepney.
I'm sure I don't know,
Says the great bell of Bow.
Gay go up and gay go down
To ring the bells of London Town."

Just as the last player reaches the bridge, the bridge-holders utter the words—

"Here comes a candle to light you to bed,
And here comes a chopper to chop off your head,"

at the same time keeping the last player a prisoner. The captive is then asked whether he will be English or French, and according to his decision he is placed behind either the Frenchman or the Englishman. Going round to their original starting place, the company again all pass under the bridge, while the rhyme is again being sung, the last one in the file, like his predecessor, being also detained and made a prisoner, and being compelled, too, to choose which country he will fight for. Thus the game proceeds until all have, one by one, been captured, and consequently two long lines have been formed of Englishmen and Frenchmen. The grand conclusion consists in these two powers vying with each other as to which is the stronger, the test being that those who can pull their opponents from their position have won the game.

ORIGINAL SKETCHES.

Each person must be supplied with paper and pencil. At the top of the paper a small sketch is then drawn by every one, representing some historical incident, either from English or foreign history, or any other subject chosen. The proper way is for the subject to be announced as soon as the papers are delivered, but, if preferred, no restriction of any kind need be placed upon the artists; all may draw whatever they like. We need not remark that the latter method renders the guessing business a much more difficult affair. On the sketches being completed, each player passes his paper to his left hand neighbour, who, after closely examining it, writes down at the bottom of the paper what he imagines the drawing is meant to represent. The paper is then folded over so as to conceal the writing, and passed on again to the left, every player examining each sketch as it reaches him, and putting down what he thinks it is intended for; but on no account must any one look at what has already been written. As soon as the sketches have been scrutinised and pronounced upon by every player, they are collected, and the various opinions are read aloud.

"OUR OLD GRANNIE DOESN'T LIKE TEA."

After being seated in order, the first player announces the fact that "Our old Grannie doesn't like Tea." The person sitting next inquires what it is the old lady likes in preference, the answer to the question, if right, will name some article in which the letter T does not occur. For instance, if Grannie can't eat potatoes, or carrots, or vegetables, she may still be passionately fond of peas and beans and cauliflowers. Coffee and cocoa, too, she is able to drink, although tea has the effect of giving her indigestion and making her frightfully ill.

PAIRS.

Great fun may be extracted out of this game, and it is admirably adapted to boys who (as most of us know) seem to take an intense delight in making each other appear ridiculous. Each gentleman is requested to choose a partner for himself. Should ladies be among the company, it is needless to say that the game will be all the more interesting, especially if there be a sufficient number to provide a lady for each gentleman. One gentleman alone, who personates a lawyer, walks up and down the room in front of the various couples, asking questions of any one he pleases. The answers to his questions must be answered, however, not by the person addressed, but by his or her partner. It may, therefore, be easily imagined what inappropriate replies may be given. For instance, the lawyer may ask a lady what is her favourite occupation. The lady's partner, who must answer the question while she herself remains perfectly silent, may say "dressing dolls," "cricketing," "playing leap-frog," or anything else equally wide of the mark. The lady must patiently hold her tongue, or incur the penalty of paying a forfeit. Those who feel themselves libelled, however, by the remarks made about them by their partners, have the satisfaction of knowing that they will most likely have the opportunity of retaliating before the game is over, because when their turn comes to answer the questions addressed to their partners they can give tit for tat.

PERSON AND OBJECT.

Two of the company leave the room together, and after due consultation agree to think of some particular person, either historical or otherwise, about whom they shall be prepared to answer any question which may be put to them by their friends. Not merely, however, as in other games, is some particular person

thought of, but also something belonging to him ; for instance, part of his dress, his favourite dog, his friend, or perhaps some peculiarity by which he is so well known that it has actually become part of himself ; and on returning to the room, one of the two who have been absent must represent the person, and the other the object. In turn they must then submit to be questioned by the company, who will alternately address themselves, first to the person, then to the object. Supposing Mr. Gladstone to be the person fixed upon, his axe might be chosen for the object, or Cromwell and his wart, or Lord Beaconsfield and his little curl. While the questioning is going on, the person must not volunteer any information relative to the object, neither must the object give any light relative to the person ; each must accurately but briefly speak for himself alone until the company succeed in guessing who and what have been the subject of thought.

THE PORK-BUTCHER.

This game is very much like that of the Spanish Merchant, the only difference being that instead of the players representing themselves as Spanish merchants, they carry on for the time the business of pork-butchers. The first player begins the game by saying, "I have just killed a pig, and shall be glad to sell portions of it to any of you. What part will you take?" he continues, addressing his right-hand neighbour. The trick of the game is that whatever part the purchaser shall choose, the corresponding part on his own person must, as he names it, be touched by him.

POSTMAN'S KNOCK.

This game, sometimes used as a forfeit, is played in the following manner :— First of all, some one is stationed at the door, inside the room, to answer the repeated knocks that will be made. Another of the company begins the game by going out of the room, and presently making himself heard outside as postman, by giving a double knock. On the door being opened he is asked for whom he has a letter, and how many pennies the owner will have to pay for it. The person to whom the imaginary letter is addressed must then go outside the room, and give the postman his fee, not in pennies, but in kisses, after which he or she must take his or her turn as postman.

PROVERBS.

In choosing a proverb for this game, the simpler ones will be found the best, as those with long, prominent words are difficult to introduce. One of the company having retired, a proverb is fixed upon. The absent one is then called in, when he at once begins by asking a question of each of the company, the first one of whom must mention in his reply the first word in the proverb ; the second player must mention the second word, and so on, until all the words have been brought in. Sometimes when the company is large, the proverb is repeated twice in the same round, though when this is done the person who is guessing should be told of the arrangement. As soon as the proverb is discovered, the person whose word gave the clue to the mystery must be the next guesser.

THE QUAKERS' MEETING.

Those of the company who wish to play arrange themselves in a straight line on the floor, all kneeling on the right knee, while on the other knee they must have their hands resting and twist their thumbs. Their countenances must all wear a very solemn, woeful appearance ; indeed, the rule is that should even a smile be detected on the countenance of any one a forfeit can be demanded. The following conversation is then carried on, each sentence of which, both question and

answer, must be repeated in turn by every one of the players—all remembering that the utmost gravity must be sustained throughout:—

“ Well, friend, and how art thou ?

Hast thou heard of Brother Obadiah's death ?”

“ No. How did he die ?”

“ With one finger up, (The player must here cease twisting his thumbs, and hold up the forefinger of the right hand).

With one eye shut, (Here he must shut the left eye).
And shoulder all awry.”

“ How did he die ?”

“ In this way.”

When the conversation reaches this point the player at the top of the row gives his neighbour a good strong push, which in time has the effect of precipitating all the players on the floor, and thus turning the solemn meeting into a very uproarious one.

THE RESTING WAND.

It is necessary in playing the Resting Wand that at least two people should be acquainted with the mystery attached to it, and that they should make an arrangement with each other beforehand to understand each other's movements. One of these two persons is blindfolded, and placed with his back to the company, while his companion, with a staff in his hand, stands facing them. The latter of the two then begins an animated conversation with his friends, trying when talking to them to make frequent mention of their names. Stopping occasionally, he touches some one with the wand, saying at the same time to his friend, who is blindfolded, “ On whom does the wand rest ?” Strangers to the game will not all at once perceive that the wand is always made to rest on the person who was the last but one to speak, and that it is on account of this arrangement that the blinded person is able to mystify his friends by answering correctly the question, “ On whom does the wand rest ?”

RETSCH'S OUTLINES.

By those at all skilled artistically great fun may be extracted in the following manner:—Each person must be provided with a piece of paper and a pencil. Upon every paper the owner then scribbles a crooked or straight line of any description and passes it on to the right-hand neighbour. All are then expected to make the line on their paper the foundation for a little picture of some kind; and although very

often the results are exceedingly absurd, it is possible on the other hand for pretty little sketches to be thus produced. The original outline must be drawn very thickly to distinguish it from the rest of the figure, as in the woodcut.



RETSCH'S OUTLINES.

THE REVIEWERS.

Each player is provided with a piece of paper, on the top of which must be written by every one the title of some book; a real title may be chosen or an imaginary one. The papers must then all be folded down, so that no one but the writer may know what is concealed underneath, and passed on to the left neighbour. Below the fold a second title must be added, the paper again folded down, and again passed on to the left. A motto of some kind must come next, or a piece of poetry; and, lastly, two or three opinions of the press. It perhaps might be as well to observe that the great charm of the game consists in every contributor being ignorant of what has previously been written, therefore, the honour of all is depended upon not to look under the folds. A collection of the papers is then made, and they are read aloud; the results being something of this description:—

A FEW BRIGHT SPOTS IN HISTORY;

OR, THE MANX CAT.

BY A. WISEACRE.

“A thing of beauty is a joy for ever.”

“We would strongly recommend this new and valuable work to all lovers of geology, as one of the greatest helps they could possibly procure.”—*Morning Chronicle*.

“No gentleman’s library will be complete until this gem of literature has its place on one of the book-shelves.”—*Weekly Gazette*.

THE WILD MAN OF THE WOODS;

OR, LOVE IN A COTTAGE.

BY SAM THE NEWSMAN.

“England, with all thy faults I love thee still,
My country!”

“It would be useless recommending this book for perusal to any one not gifted by nature with the highest of intellectual powers; no ordinary reader could appreciate its hidden depth of meaning.”—*Westfield Review*.

“A harmless little book, well adapted for children. There is nothing to complain of in its moral tendency.”—*Cornwall Leader*.

JOHN AND HIS TWIN BROTHER;

OR, LIFE IN THE ARCTIC REGIONS.

“Be good, sweet maid, and let who can be clever;
Do lovely things, not dream them, all day long.”

“We have read this book with intense interest, and cannot speak too highly of it as a work of art.”—*Working Man’s Friend*.

“An invaluable book for young housewives.”—*Liverpool Guardian*.

RHYMES.

This game is one that even very young children can understand. One of the company thinks of a word rhyming with another word which he mentions. The aim of the party then is to guess what the word thought of can be. The rule is that no one should give a name to what they guess, but describe it instead, and each of the company in turn is entitled to a question. Should the word thought of be “bag,” rhyming with “rag,” the questions must be put thus:—

“Is it a necessary part of a boot-lace?”

“No, it is not a tag.”

“Is it the name of a horse?”

“No, it is not a nag.”

“Is it the name of an elegant horned animal?”

“No, it is not a stag.”

“Is it useful to schoolboys and girls?”

“Yes, it is a bag.”

RULE OF CONTRARY.

Almost any number may play at this game if, instead of being supplied with a pocket-handkerchief, as is generally the case, a small tablecloth be used instead. All stand round, and each person takes hold of the cloth with one hand. One person acting as leader, while holding the cloth with the left hand, pretends with the right hand to make mysterious characters on the cloth, at the same time pronouncing the following rigmarole:—"Here we go round by the rule of contrary. When I say 'Hold fast,' you must let go. When I say 'Let go,' you must hold fast." Then crying either "Let go" or "Hold fast," the party must do exactly contrary to what they are told; any one who should fail to do so must pay a forfeit.

RUSSIAN GOSSIP.

This game is quite as interesting, and perhaps a little more modern than many of those that have been so long established. First of all, the young people take their seats next each other in a circle. The one at the end then relates to his neighbour some little incident, a piece of news he has heard, an anecdote, or anything else that may occur to him. The neighbour then relates it to the next person, who relates it to his neighbour, and so on until every one of the party has heard the story. The last person who has been communicated with then repeats what has been told him, and very amusing it generally is to find how totally unlike the original the incident has become, after being cropped and added to by the different narrators.

THE SCHOOLMASTER.

Among stirring games one that is always a success when played with energy is that called The Schoolmaster. The one of the party who volunteers to be master of the ceremony places himself in front of his class, who are all seated in a row. If agreeable, he can examine his subjects in all the different branches of education in succession, or he may go from one to the other indiscriminately. Supposing, however, he decides to begin with natural history, he will proceed as follows:—Pointing to the pupil at the top of the class, he asks the name of a bird beginning with C. Should the pupil not name a bird beginning with this letter by the time the master has counted ten, it is passed on immediately to the next, who, if successful, and calls out "Cuckoo" or "Crow," &c., in time, goes above the one who has failed.

Authors, singers, actors, or anything else may be chosen, if the schoolmaster should think proper, as subjects for examination; but, whatever may be selected, the questions must follow each other with very great rapidity, or the charm of the game will be wanting.

SHADOW BUFF.

This game, if well played, may be productive of much merriment. A large white sheet is first hung securely on one side of the room, and on a table some distance behind a very bright lamp must be placed. All other lights being extinguished, one of the party takes a seat on a low stool between the lamp and the sheet, but nearer the latter than the former. One after another the company pass behind him, their shadows of course falling upon the sheet as they pass. It is much more difficult than most people would imagine to guess the original from the shadow, especially as in this game it is allowable for the players to disguise themselves to some slight extent. Gestures of any kind may be practised, masks may be worn, false noses, or anything else of the kind, to render the work of the guesser more difficult, for this always tends very considerably to add to the general fun.

SHOUTING PROVERBS.

A game that is much more speedily despatched, and much more boisterous than the ordinary game of Proverbs, is this one called Shouting Proverbs. A proverb having been selected, one word of it is given to each of the company, which he must shout clearly and distinctly when told. The person to whom the proverb is unknown then stands as near the company as they will permit him, while he says the words "Charge! Present! Fire!" As soon as he utters the word "Fire!" the party all shout their words together, and from this confusion of sounds he is expected to guess the proverb. Generally the shouting has to be repeated many times before the proverb can be detected.

"SIMON SAYS."

In this game an imaginary Simon is the presiding genius, and the orders of no one but Simon are to be obeyed. The leader of the company generally begins by saying, "Simon says, 'Thumbs up,'" when every one must immediately obey the command of Simon or incur the penalty of paying a forfeit. Simon may then say, "Wink your left eye," "Blow your nose," "Kiss your neighbour," or anything equally absurd. Whatever Simon says must be done. No command, however, not prefaced by the words "Simon says" is to be regarded. With the idea of winning forfeits, the leader will endeavour to induce the company to do certain things not authorised by Simon—indeed, the fun of the game consists in every one doing the wrong thing instead of the right one, and in having a good collection of forfeits.

THE SPANISH MERCHANT.

After seating themselves in order round the room the first player begins by saying to his neighbours, "I'm a Spanish merchant." The neighbour then replies, "What do you sell?" This question the first player responds to by naming any article, which at the same time he must touch. For instance, should he say he sells gold, he must unobservedly touch some gold article—a piece of money, a gold ring, a breast-pin, or anything else of gold. Silk, cloth, linen, carpets, boots, glass, indeed any conceivable thing, may be articles of merchandise; the only thing to be remembered is that whatever is chosen must be touched.

THE SPANISH NOBLEMAN.

The company arrange themselves in a long straight line at one end of the room, excepting one person, who is to be the nobleman, and he must take his place at the other end of the room. Advancing to his friends, the nobleman must then sing the following lines:—

"I am a nobleman from Spain,
Coming to court your daughter Jane."

To which the rest reply:—

"Our daughter Jane is yet too young,
She has not learnt her mother's tongue."

The nobleman replies:—

"Be she young or be she old,
For her beauty she must be sold;
So fare you well, my ladies gay,
I'll call again another day."

The company then advance singing:—

"Turn back, turn back, you noble lord,
And brush your boots and spurs so bright."

Whereupon the Spanish Nobleman replies, with something of rebuke in his tone:—

“My boots and spurs give you no thought,
For in this land they were not bought,
Neither for silver nor for gold.
So fare you well, my ladies gay,
I'll call again another day.”

All then advance, saying:—

“Turn back, turn back, you noble lord,
And choose the fairest in your sight.”

The nobleman, fixing upon—supposing we say Kitty—then says:—

“The fairest one that I can see,
Is pretty Kitty : come to me.”

The couple go back hand in hand rejoicing. The whole performance is then recommenced, but the second time, instead of only one nobleman two noblemen advance, and the rigmarole is gone through again, ending at last in another companion being induced to join the little band of noblemen. Thus the game is carried on, until in the end all have gradually been won over to the opposite side.

SPELLING BEE.

Not long ago the excitement about Spelling Bees was very great. Both publicly and privately these entertainments were held for a very considerable period; indeed, none of us felt sure on leaving our homes whether we should not be called upon before our return to spell no end of hard-sounding words that, hitherto, we had scarcely heard of or seen. Consequently, the dictionaries were all in demand, and young people, instead of giving all their time to light literature, might have been seen privately hunting up such words as Phthisical, Æsthetics, Dithyrambic, Isosceles, and others equally difficult, in order that they might not be disgraced as bad spellers. Now the rage has subsided, though no doubt the good produced by the Spelling Bees is still to be felt. As a Round Game, the Spelling Bee is conducted much the same as “The Schoolmaster,” elsewhere described. The company take their places as if in class, going up or down as they acquit themselves creditably in the estimation of their master. The words must of course be made difficult or easy, to suit the capacities of the spellers. There would be no fun in exposing to general ridicule the ignorance of a boy or girl whom illness may have made more backward in knowledge than his or her schoolfellows.

SPOON MUSIC.

A very good effect may be produced in the following manner:—The performers who are to assist in the entertainment must each be provided with a wine-glass and a spoon. The accompanying air (or other) is then played over, and when the pianist arrives at the passages marked *spoons*, each glass is to be touched lightly on the edge with the spoon. By way of variety, the second time the air is played clapping of hands may take the place of the spoons; and the third time whistling may be adopted. The fourth time a good hearty laugh from every one will sound well, after which the game may begin again with the spoons.

The idea suggested may of course be carried out still further. Any air may be selected, the playing of which may be interspered, at suitable intervals, by the jingling of spoons, laughing, and whistling.

If done with delicacy it is astonishing what a pleasing effect may be produced, especially if the wine-glasses provided be of thin glass. In the hands of adepts at the game the glass will be in no danger of being broken, because the more

gentle the touch the greater will be the success achieved; nothing is needed but clear, gentle ringing notes, sounded in harmony.



THE STAGE COACH.

Now for a really stirring game, provided that in the party a few energetic lively young people are to be found. Many a hearty laugh has been heard from big people, as well as little ones, while the stage coach has rattled along through the rain and snow and sunshine round the drawing-room table. The leader tells every one to assume a name connected in some way with a stage coach. Any of the four wheels, the horses, the bridles, the whip, the windows, the cushions, any of the passengers, or numerous other things, may be chosen. The objects selected are generally written down on paper, linked with the name of each owner, unless it be that the leader can trust to his memory without any such assistance. He then begins his narrative, which must be as lively and ridiculous as possible, telling how the stage coach started, where from, where it was going, how many passengers there were, what they were like, and so on. The narrator will find that one thing suggests others to his mind; the difficulty will probably be to narrate every incident that occurred as the conveyance rolled along. We must not forget to say that the greatest part of the fun consists in the jumping up, twirling round, and changing seats, that have to be done while the narrative is proceeding. The names assumed by the company are mentioned as frequently as possible, each of whom must recognise the call by rising from his seat, turning round, and then sitting down again. When the stage coach itself is mentioned by any one all must change places, the person left without a seat being called upon for a forfeit.

STOOL OF REPENTANCE.

The players seated round the room, a stool is placed in the centre, which one of the company volunteers to occupy while certain charges are being made against him. One person acting as Lord President then goes round the room, inquiring of each player what charge he or she has to make against the culprit, who is humbly

sitting on the stool of repentance. All the accusations are whispered into the president's ear, who will do wisely, should the party be a large one, to be supplied with paper and pencil, and attach to each accusation the name of the person who makes it. All being in readiness, the president then begins by saying, "Prisoner on the stool of repentance, you are accused of (being conceited, or noisy, or vain &c.). Can you tell me the name of the person who makes this serious charge against you?" Should the prisoner guess rightly, the accuser must pay the forfeit, and prepare himself to take the place of culprit in the next game; but, on the other hand, should the prisoner guess wrongly, he must pay the forfeit himself, and keep his seat on the stool of repentance. It sometimes happens that when the prisoner has at an early stage of the proceedings guessed correctly, and by so doing has earned his freedom, he still wishes to hear the rest of the accusations. If such be the case, he is entitled to have his wish gratified, being willing, of course, to pay a forfeit for every mistake; and when all have been heard (if he has succeeded in guessing rightly more than once), he has the privilege of choosing the next culprit to occupy the seat that he has vacated.

TABLEAUX VIVANTS.

In the estimation of some people Tableaux Vivants possess even greater attractions than Charades, simply for the reason that in their representation no conversational power is required. The performers have to remain perfectly silent, looking rather than speaking their thoughts; proclaiming by the attitude in which they place themselves, and by the expression of their countenances, the tale they have to tell. To others, however, this silent acting is infinitely more difficult than the incessant talk and gesticulation required in Charade actors. Naturally active, and gifted with a ready flow of words, the ordeal of having to remain motionless and silent, for even three or four minutes, would be equal to the infliction upon themselves of absolute pain. Still we must not be led to think that individuals devoid of character are the most eligible to take part in Tableaux Vivants; no greater mistake could be made. The affair is sure to be a failure unless the actors not only have the most perfect command of feeling, but are able also to enter completely into the spirit of the subject they attempt to depict. It would be useless to expect a lady to personate Lady Macbeth who had never read the play, and who, therefore, knew nothing of the motives which prompted that ambitious woman in her guilty career. In order to give effect to the scene the subject must be familiar and thoroughly understood by the actors. There is seldom any difficulty in the selection of subjects. Historical remembrances are always acceptable, and can be made to speak very plainly for themselves, while fictitious and poetical scenes may be rendered simply charming. Speaking from experience, one of the prettiest Tableaux Vivants we ever saw was one taken from Shakspeare's "Winter's Tale." As soon as the curtain was drawn aside, Hermione was seen on a raised pedestal, so lifeless and calm she might well have been mistaken for marble. Before her was standing Leontes, an old man, with his daughter, Perdita, hanging on his arm, both evidently struck dumb with amazement at the likeness of the Statue to her whom for so many years they had believed to be dead; while Camillo, Florizel, and Polixenes also stood gazing in wonder. The good Paulina, dressed as a Sicilian matron, stood behind the Statue, or rather on one side, as the exhibitor of it. Presently were heard strains of gentle music, when the Statue stepped gracefully from her elevation, gave her hand to Leontes, and was embraced by him. The curtain here was drawn forward again, hiding from our sight a picture that ever since has been printed indelibly upon our memory.

For comic tableaux scenes from fairyland or from nursery rhymes, would answer the purpose admirably. Some young lady with long hair might be made to be seen kneeling as Fatima, before her cruel, hard-hearted husband, Blue Beard; he with her hair in one hand, and a drawn sword in the other, just about to cut off her head; the tearful sister meantime straining her eyes out of the window, to catch sight of her brothers, who she knows are coming with all speed to the rescue. As to dressing and scenery, they are matters that must be left to the taste and fancy of the managers of the concern, who will soon discover that the success of Tableaux, even more than Charades, depends very greatly upon dress and surroundings. Charades speak for themselves, but Tableaux are so soon over, that unless the actors assume somewhat of the dress of the characters they attempt to personate, the audience would not readily guess the subject chosen. There is little doubt that with both Charade performers, and with those who take part in Tableaux Vivants, the assumed dress gives an air of importance to the proceedings which would not otherwise exist, and acts like a kind of inspiration (upon young people especially), making them perhaps more thoroughly lose their own personality in trying to be for a time some one else.

THE TELESCOPIC GIANT.

Another method (besides that already described) of making a giant is to fasten a hat to the top of a broom or a long stick, and then a little below the hat to fix a small hoop to form the shoulders. A very long mantle of some description must then be firmly fastened on as gracefully as possible, under which a gentleman, the taller the better, must take his post, holding in his hand the stick. As may be imagined, the result is exceedingly ridiculous, owing to the giant being able to make himself tall or short, as it may suit his inclination. At one moment he may shoot himself out to a great height, then become quite small, chattering and gesticulating all the time, to make the affair more comical.

THINK OF A NUMBER.

Tell your neighbour to think of any number he likes, but not to tell you what it is. Tell him then to double it; when he has done that, let him add an even number to it, which you yourself must give him; after doing this he must halve the whole, then from what is left take away the number he first thought of. When he shall arrive so far, if his calculations have all been made correctly, you will be able to give him the exact remainder, which will simply be the half of the even number you told him to add to his own.

THIS AND THAT.

The trick in this game that must be understood by the two of the company who are to take the leading part in it, is nothing more than that the word *that* is to precede the article that has been chosen for guessing. For instance, one of the two players acquainted with the game goes out of the room while an article is chosen by one of the company as *the object* to be guessed. The absent one is then recalled, when the second player acquainted with the game remarks that something in this room has been touched, and requests him to name the article.

"Do you think it was this music book?"—"No."

"Was it the arm-chair?"—"No."

"Was it the writing desk?"—"No."

"Was it this chair?"—"No."

"Was it that bracket?"—"Yes."

The performance may be repeated until the secret has been discovered.

THROWING LIGHT.

This game is a wonderfully interesting one, though, like all others, its success depends very greatly upon the amount of energy that is thrown into it by the players. A word is chosen to be the subject of conversation by two of the party, and must be known to themselves only. It should be a word to which several meanings are attached, so that the remarks made in reference to it may be ambiguous and puzzling to the rest of the company. The two persons who know the word begin a conversation, referring to the word in all its different meanings, the others being allowed to add their remarks as soon as they have guessed what the word is.

Supposing the word fixed upon to have been *Hare*, which is also spelt in another way, the conversation could be very easily sustained in something like the following style:—

1st player.—“I saw one the other day when I was out driving in the country.”

2nd player.—“I had one sent for a Christmas box.”

1st player.—“My own is dark brown.”

2nd player.—“And mine is nearly black.”

1st player.—“Do you like it hot or cold?”

2nd player.—“Between the two, I think.”

Here some one who has discovered the word may remark, “Don’t we read of some one in the Bible who might have lived longer if he had not possessed quite so much of it?” Thus the chat runs on until the players, one by one, as they guess the word, are entitled to take part in the conversation. The penalty for making a mistake and joining in the conversation before the right word has been discovered, is to have a handkerchief thrown over the guilty person’s head, which must be kept on until the word is really found out. The words Lock, Ball (Bawl), Deer, Key (Quay), Pen (Penn), Pain (Pane), Boy, Handel (Handle), Whale (Wail), and similar words with two or three meanings, are such as will be required.

TOILET.

We must not forget to name the old-fashioned game of the Toilet, which no doubt, if the truth were known, came in, like Blind Man’s Buff, as far back as the time of William the Conqueror. The original idea in connection with it is for each person to fix upon some article indispensable to a lady’s dress. Her fan, pocket-handkerchief, slipper, scent-bottle, and so on are chosen, an article to each player. The leader, supplied with a wooden trencher, generally begins by announcing the fact that my lady is invited to a ball, consequently her wants during the time of dressing will be very numerous. Probably the brush and comb will first be called for to dress the lady’s hair, when the owner of these articles must respond to the call by taking up the trencher before it has ceased spinning; it being the rule that every one who makes a call shall spin the trencher. Instead of articles of dress, flowers have frequently been chosen by young ladies, each one representing her favourite flower, and in order to make the game suitable for use among boys it may easily be still further altered, according to fancy, the variations of course depending upon the articles chosen. In all round games, however, boys and girls generally play together, and it is usually found that a good girls’ game is equally attractive among the boys. It must not be forgotten, in playing this game of Toilet, or Trencher, as it is also called, that when the word “Toilet” is used, or any other word that is fixed upon instead, every one of the company must change places. Should any one fail to do this, a forfeit can be demanded as a penalty.

THE TRADES.

In this game each player chooses some trade. For instance, one may be a carpenter, another a gardener, another a tailor, and so on. One person must then be nominated King, and at a certain signal from him every one must begin working at the trade he has chosen, imitating it by action the best way he can. After working for some time, the King may, if he chooses to do so, abandon his own trade and take up that of one of the others. Should he do this, every one must stop working, excepting the person whose trade he has adopted, and he must work at the King's trade instead of his own, until the King is inclined to return to his original occupation, when all may go on working as before.

Another game, quite as interesting as this one, though not perhaps so well known, is also played under the name of Trades. Each person fixes upon some trade which, for the time, he is supposed to follow. The leader of the game, or one of the party gifted with inventive faculties, then commences a narrative in which all the various branches of business occupy a conspicuous place. For instance, the narrator may recount to the company the amusing adventures of some old lady who set out one morning to do the family shopping. She first called at the *butcher's*. (Here the person who has chosen butchering as his trade must immediately, before ten has been counted, name a joint of meat;) and having extracted a promise from the *butcher* (another joint of meat must here be named) that her order shall be attended to at once, she went on to the *greengrocer*. (Here the greengrocer must mention something sold by him.) She then went on to the *baker's*, and having bought all she wanted for dinner, thought she would call on her way home at the *shoemaker's* to inquire if her shoes were mended. In a style of this kind the adventures of the old lady may be carried on to any length, the interest of the game depending, as in all games, on the amount of energy thrown into it. The great fun of the game also consists in the trades being mentioned very frequently, so that every one in the room may feel the necessity of being constantly on the watch, knowing that the various articles they are supposed to have in stock may at any moment be demanded of them.

THE TRAVELLER'S ALPHABET.

The players sitting in a row, the first says, "I am going on a journey to Amsterdam," or any other place beginning with A. The person seated next inquires, "What will you do there?" The verbs and nouns used in the reply must begin with A. The next player must adopt B, the next C, and so on, until the whole of the alphabet has been gone through; but perhaps an example will best illustrate our meaning:—

John.—"I am going on a journey to Amsterdam."

Effie.—"What will you do there?"

John.—"I shall articulate ancient anthems."

Effie.—"I am going to Buckingham."

Will.—"What will you do there?"

Effie.—"I shall bewilder the beautiful butterflies."

Will.—"I am going to Cambridge."

Mary.—"What will you do there?"

Will.—"I shall chase crawling caterpillars."

Mary.—"I am going to Dundee."

Robin.—"What will you do there?"

Mary.—"I shall drown the dreadful dogs."

Robin.—"I am going to Eastbourne."

Nora.—"What will you do there?"

Robin.—"I shall enquire for empty egg-shells."

And so on to the end of the alphabet, or until another game shall be called for.

TWENTY QUESTIONS.

In this game one person goes out of the room while the rest of the company choose some subject which he will be expected to find out by the time he has asked twenty questions. When he has received the twenty answers to his questions, should he still be unable to discover the subject of thought, he must not only produce a forfeit, but must also for the second time be the one to go out of the room until something else is thought of. Before doing so, however, the company may kindly allow him to ask a few extra questions, the answers to which may enlighten him on the first subject.

THE TWO HATS.

A similar game to this of the Two Hats is that known by the name of the Rule of Contrary, a description of which will be found on another of our pages. One of the company comes forward holding in his hand two hats, one of which he places on his own head, the other he gives to one of his friends. The person to whom the hat is given must from the moment he receives it make every action of his to be exactly opposite to that of the owner of the other hat. For instance, should the latter sit down his victim must immediately stand up, should he place the hat on his head his friend must stand bare-headed, should he take it off the other must put his hat on. This principle of contrary must be carried out to the very utmost, not only as far as the hats are concerned, but in every other way imaginable. When once the game is entered upon, opportunities will readily present themselves of carrying out the original idea, namely, that dictated by the rule of contrary.

"WHAT AM I DOING?"

Six, seven, eight, or more players take their seats in a straight row. Behind them the person chosen to lead the game takes his stand. Placing himself exactly behind the player seated on the top chair, he then begins to conduct himself in the most absurd manner possible; for instance, making some ridiculous grimace, shaking his fist, or any other comical antic that may suggest itself to him. After doing this for a minute or two, he then says to the player seated before him, "What am I doing?" Should the unfortunate individual be unable to answer correctly he must stand up, and until permission be given him to desist, must imitate in silence the antics the nature of which he was unable to discover. More frequently than not the guesses are quite wide of the mark, consequently the spectacle is most laughable when five or six of the company are all occupying the enviable position above described.

"WHAT IS MY THOUGHT LIKE?"

This is a pleasant fireside game that, without requiring any very great depth of thought, is made all the more interesting by the ready wit and natural ability of the players. Some particular thing is fixed upon by one of the company as a subject of thought. He then asks each one in turn what his thought is like. They say anything they choose; a rainbow, a waterfall, a monkey, an umbrella, or whatever may occur to them. The leader then informs the company what his thought was, asking each one in turn to draw a resemblance between it and the object fixed upon as a comparison. It not unfrequently happens that the best reply is given by one whose task appears to be the most difficult, owing to the utter dissimilarity of the two objects compared; an ingenious player being able to detect some point of resemblance between two things so totally unlike each other as to be almost ridiculous.

As instances of really clever and apt answers, take the following:—

- "Why is love like a canal boat?"
- "Because it's an internal transport."
- "Why are lovers like apples?"
- "Because they are often paired."
- "Why is a Scottish dance like bitter beer?"
- "Because there are so many hops in it."
- "Why is the best coal like true love?"
- "Because it always burns with a steady flame."
- "Why is a thought like the sea?"
- "Because it's a notion (an ocean)."

WHO WAS HE?

This game is not unlike the game of "Person and Object," though by many people it is considered superior. The first player begins by mentioning four distinguishing traits of either character or person belonging to some remarkable individual of whom at that present moment he is thinking. Supplied with these four facts the company are expected to guess the name of the person at once, instead of having a number of guesses, as in similar games of the kind; indeed, for every wrong guess a forfeit can be claimed.

THE WILD BEAST SHOW.

As the leader of this game will require the help of at least two of the party to assist him in his exhibition he should, if possible, select those who have already been initiated into the mysteries of the game. Retiring with his two or three friends into another apartment, he will contrive some means of fixing his menagerie behind a large curtain. In the absence of the curtain a kind of temporary screen might easily be fixed, just to give the whole affair an appearance of importance. On a small table a looking-glass should then be placed, but must be hidden from view. The leader must then take his post at the door of his establishment, and in an emphatic manner extol the beauty and value of the animals he has on view, while his partisans, crouched behind the curtain and out of sight, must, in the meantime, imitate loudly the cries of different wild animals, aiming to make the *hee-haw* of the donkey more conspicuous than any other sound. Spectators are invited to enter. On consenting to do so, each one is asked which animal he would like to see first, and whatever he says, he is shown his own image in the mirror. The great aim is to prevail upon the visitors to view the magnificent donkey that is to be heard braying, when, of course, they see nothing but their own face reflected in the looking-glass. This game, though not one of the most refined, has had the charm, we may say, hundreds of times of causing many a hearty laugh.

"YES OR NO?"

In this game one person goes out of the room, while the company fix upon some object for him to discover. On being recalled, he may ask any number of questions and any kind of questions, but the answers received by him must be simply "Yes" or "No"—nothing more.

Another way of playing at the game, which renders it unnecessary for any one to go out of the room, is for one of the company to think of something. His friends then in turn each ask him a question, the reply to which must be, as in the former method, nothing but "Yes" or "No," the questions of course continuing until the object of thought has been discovered.

TOY GAMES AND TOY-MAKING.

IN treating the subject of toy games adapted for in-door recreation, it should be stated at the outset that many of the manufactured and expensive toys which form the groundwork of an almost innumerable number of games are not described with any detail, because descriptions of these toys with their various uses are invariably supplied to their purchasers, and further instruction here cannot be needed. To those who can afford to procure a constant supply of new and original toys and games, no better means of learning of their appearance can be had than is supplied in the catalogues issued, for the most part gratuitously, or at a very small cost, from time to time, by the leading firms engaged in the toy trade.

As to the most simple toys, particularly those which can be made at home by the exercise of a little skill and ingenuity, and at small cost, it should always be remembered that the making of such simple toys is in itself a recreation, and affords that variety of amusement which makes recreation truly valuable. Again, there are many toys provided by the purveyors of amusements for the youngsters, which can neither be classified among toy games nor as toy-making; but it will not be altogether out of place to mention them here by way, as it were, of parenthesis. The toys more especially alluded to now are those intended to find occupation for youngsters not blessed with playmates, or who are sometimes without playmates.

There are toy bricks and toy building materials of endless descriptions and varieties. By the way, a very amusing and ingenious trick may be performed with a box of bricks familiar to all, that partakes of the simplest character. The bricks referred to are those about two inches long, an inch wide, and half an inch thick, which are supplied in boxes containing a large quantity of bricks all of that size. If these bricks are set up on end at distances apart of about an inch and a half to an inch and three-quarters, and the one at either end gently touched, so as to fall on to the one placed next to it, the whole set will gradually fall one after the other. The bricks may be arranged serpentine fashion, winding backwards and forwards like a figure 8 or letter S; but provided the distance named is adhered to the result will be the same, and the effect of two or three hundred bricks leisurely knocking each other down will, if the figure in which they are set up be well arranged, have an almost comical appearance.

Then, again, there is the class of toys now known by the name of the originator, "Crandall's toys," all of which are made on the principle of fitting parts of the same structure together by joints. These toys are being constantly extended and made more complicated, and they afford amusement not only to those piecing them together, but also to a numerous company of on-lookers.

Among the other leading toys for in-door recreation we would mention "Noah's Arks," "Farm Yards," "Shops," "Railways," "Omnibuses," "Tram Cars," "Wagons," "Horses" (an endless delight to the very young, which may be had in almost any form, from the simple wooden toy drawn by a handle to that now so common, which is mounted on a miniature but well-made tricycle), animals of all sorts and noises, singing and talking birds, miniature toy musical instruments, and other toys of a never-ending variety made especially for the male portion of the juvenile population, without mentioning here, in this Boys' Book, those dolls and other toys intended for the amusement of the boys' sisters and female cousins. As an illustration of the ingenuity of the toy-producers, it

may be stated that among the latest additions to the more expensive of the mechanical toys is that known as the animal album, of which we give an engraving. This book has represented on the left-hand page the figure of some animal, and on the right-hand page there is some text descriptive of the creature exhibited. On pulling a small button attached to the book, the noise or sound peculiar to the animal on the opened page will be emitted from under the opposite leaf. In the woodcut the letterpress facing the portrait of Chanticleer has been removed to show the mechanism for producing the cries of the various animals.

In short, before proceeding to the description of those toys and toy games selected for more detailed treatment, it may be observed that the possession of toys is in itself a good thing; that the making of and making use of them is better; that the capability of obtaining amusement from those owned, be they simple or be they complicated, is better still; but that it is best of all to be able also to be the means of imparting amusement to those about us.

THE ANIMAL ALBUM: A TALKING PICTURE-BOOK.

ÆOLIAN HARP.

This interesting little toy is best if made on a long box of very thin deal wood, about four or six inches deep, a circle an inch and a half in diameter, in which some small holes are to be drilled, being marked on the upper side of the box. Bridges, like the bridge of an ordinary violin or fiddle, are to be fastened on to each end of the upper side, and over these bridges are to be passed a number of strings of very fine cat-gut. The strings at one end are to be secured in the framework of the box, and at the other on screw pins, which are themselves fastened to the box. The strings can then be relaxed or tightened, as desired, by turning these pins, and the notes emitted by the different strings altered and arranged according to fancy. The instrument so made should be blown upon or placed in a current of air where the wind can pass freely over it, and then, according to the degrees of strength with which the strings are blown upon, different sounds will be produced.



ANIMATED SERPENT.

ANIMATED SERPENT.

The animated serpent is a simple and pretty toy. To make it, obtain, if possible, a piece of thin sheet copper or sheet brass, and if not, a piece of card of firm

substance, but not too thick. Draw upon the material the form of a coiled-up serpent; cut out the serpent with the point of a sharp pen-knife, and fasten a thread through the tip of the tail. When this is done, fasten to the mantelpiece, or to some board to be placed thereon, the other end of the thread, taking care that the stove register is open. The weight of the serpent's body and head will cause the coils and head to fall below the suspended tail, and then, as a current of air is always passing up an open chimney, the serpent will revolve with more or less rapidity, according to the strength of the draught of air. It is well that the serpent when made should be striped green, black, and yellow, and should have glass beads, to represent eyes. Any situation in which there is a draught of air will be suitable, as well as the chimney-piece, in showing off the toy when made.

ANNULETTE.

See "Parlour Croquet."

APPLE MILL.

This is a top-toy readily made with a nut, an apple or potato, a wooden skewer, and a piece of string. First procure a good-sized Spanish or Barcelona nut, and through it bore a small hole, carefully removing all the kernel therefrom, and then make another small hole in one side of the shell. Pare down an ordinary wooden meat-skewer until it is thin enough to pass through the nut at the holes first bored therein, being careful to leave a head to the skewer at the top to prevent it passing entirely through the nut-shell. A piece of string should next be attached to the skewer at a point just beneath the head, the opposite end of which is to be passed through the hole in the side of the nut. The string is then to be wound round the skewer as the string is wound round an ordinary humming-top, leaving a small piece to pull. If an apple or potato is then stuck upon the pointed end of the skewer, and the string is pulled as when a humming-top is to be spun, the "apple mill," as made above, will spin round with considerable velocity.

APPLE WOMAN.

This is an ingenious hand-trick, and consists in so dressing up the hand as to make it represent an apple woman.

Clench the fist, holding it knuckles upwards, covering the top joint of the thumb with the top joints of the fingers. Draw on these portions of the forefinger and thumb, forming the front of the clenched fist, a face, using a few bold dots and lines to represent the eyes, eyebrows, nose, &c. Make a cap to fit the hand, and drape a pocket-handkerchief over all, fastening it as a shawl in front. The old woman so made may be made to seem to speak by slightly moving the knuckle of the thumb up and down, and to smoke by sticking a pipe between the forefinger and the thumb, the space between which joints will represent the mouth. The above illustration is a fair representation of the apple woman's face, and a careful inspection will show how the thumb and fingers are to be arranged.

APPLE WOMAN.

BANDILOR.

This is a toy made of hard wood, and in appearance is not much unlike a pulley with a very deep groove. A piece of string is to be wound round the groove, a hole being made in the centre of the wood, through which the end of the string has first to be secured. In playing with the toy, the loose end of the string is to be held between the forefinger and thumb, and the grooved piece of wood is to be let fall. The string is thus unwound, and if the fall of the wood is suddenly checked by a sharp jerk, the Bandilor will commence to rise, and in this way may be made to continue alternately descending and ascending for a considerable time. This toy is sometimes known by the name of Quiz.

BATTLEDORE AND SHUTTLECOCK.

This is a game equally for in-door and out-door recreation, but as the mode of playing and the materials have been fully described in a previous page, the reader is referred to the account there given (p. 280).

BELL AND HAMMER.

See "Schimmel."

BIRD WHISTLES.

Whistles to imitate the songs of birds may be readily made in different ways. Remove the spout from a small toy teapot, make a whistle at the lower end of a quill, and fit that end to the hole of the teapot left upon the spout being removed, then fill the teapot rather more than half full of water, blow the whistle, and clear bird-like notes will be sounded.

Another form of bird whistle may be made out of a piece of elder or willow. Make in the middle of a piece of either of these woods a whistle, the wood being, of course, first hollowed out. Place one end of the whistle so made in the mouth, and the opposite end just under the surface of a glass of water. By then blowing, the bird-like notes, as with the quill and the teapot, will be obtained. These whistles may be made of metal or glass as well as wood.

BIRDS, BEASTS, AND FISHES.

See "Slate Games."

BOMBARDMENT.

See "Cannonade."

BOTTLE IMPS.



BOTTLE IMPS.

Obtain from the toy-shop some small enamelled figures that are made partially hollow towards their lower part, place them in a glass jar filled quite full to the brim with water, and carefully close the jar by covering it tightly with a piece of parchment. Now, by alternately placing the hand upon the cover and lifting it off again, the figures are made to descend and ascend in the water. This is caused by the hollowness before mentioned, the cavities in the figures retaining a certain quantity of air, and imparting the requisite buoyancy to them.

When the hand is pressed upon the parchment cover of the bottle the water rises, in consequence of the pressure, into the figures. The air so being compressed into less space, renders the imps less buoyant, and they fall; on the pressure being removed they rise again.

BROTHER JONATHAN.

This is a game of American origin, and consists in pitching a copper or some other convenient object at the spaces of a diagram arranged and numbered, as shown in the accompanying plan. The larger spaces should bear the smaller numbers, and the smaller spaces the larger numbers. A mark from which the pitch is to be made must be arranged, and those pitches only count which are made into one or other of the compartments; pitches made upon the different lines are not counted. The number marked in the compartment pitched into counts towards game, which may be fixed at any number according to the pleasure of the players.

20	3	4
11	20	10
2	7	9
20	1	20
6	8	5

BROTHER JONATHAN.

Crack Loo is a somewhat similar game, and it consists in pitching on a boarded floor with the object of pitching on one or other of the cracks separating the boards.

CAMERA (MINIATURE).

The materials required to make this toy are a small pill-box, a small piece of broken looking-glass about half an inch square, and a little piece of beeswax. Bore a small hole in the centre of the lid of the pill-box, and another hole in the side of the box; then, by means of the beeswax, stick the bit of looking-glass across the bottom of the box, at an angle of forty-five degrees. By looking now through one of the holes in the box the reflection of objects passing behind will be seen. In making a miniature camera it is not necessary that the materials used should be so small as those here set forth, but even of such materials as those mentioned an effective little toy may be easily constructed, and more ambitious cameras are to be made on just the same principle.

CANNONADE.

The game of Cannonade, or Castle Bagatelle as it is more generally called, is a capital Round Game. The rules for playing it, which are supplied with the board and other apparatus, are somewhat intricate, and the toy is too elaborate to be

made except at a manufactory. A number of miniature castles, enclosed in miniature fortresses, are arranged inside and around the edge of a circular tray board; a number of well-turned balls, equal to the number of castles being played, are then placed tolerably near each other towards the middle of the board, and among the balls so placed each player alternately spins as vehemently as possible a good-sized teetotum; the teetotum sends the balls flying among the castles, and the owners of the castles

CANNONADE, OR CASTLE BAGATELLE.

overtaken pay forfeit to the spinner of the teetotum, while the owners of the castles that remain standing receive forfeit from him.

There is a version of this game known at the toy-shops as the "Game of Bombardment." It is a German introduction, and although not so good a game as that

of Castle Bagatelle, is very similar in principle, affords good fun to a round party, and is not quite so expensive to purchase as the older English toy.

CARPET CROQUET.

See "Parlour Croquet."

CASTLE BAGATELLE.

See "Cannonade."

COMMON WHISTLE.

But little description either of the Common Whistle, or of how to make it, is necessary, it being so well known. The tin whistle can hardly be made except with the aid of expensive tools, but it may be purchased at a very trifling cost. No lad, however, need be without a whistle even when no toy-shop is near. A good whistle may be made out of almost any straight piece of scooped-out wood, the model of the tin whistle being adhered to as closely as possible. A nice piece of elder neatly carved and plugged may even be made to do duty for a miniature flute, and so made, various notes are to be extracted from it.

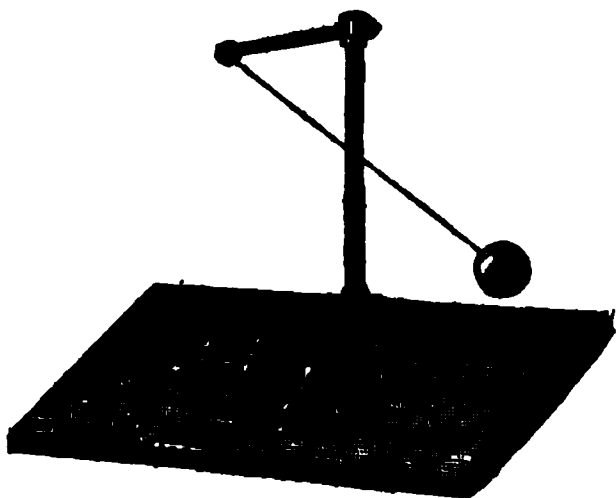
CRACK LOO.

See "Brother Jonathan."

CUP AND BALL.

The Cup and Ball has long been a favourite toy. It consists of a stem of ivory or some hard wood, one end of which is pointed, while to the other is fixed a small shallow cup. To the stem an ivory or hard wood ball is attached by means of a piece of string, and in one side of the ball a hole is drilled into which the pointed end of the stem fits. The game is, when the ball is loosely attached to the stem, to throw it up so as to catch it either within the cup at the one end of the stem, or on the point at the other end, the latter feat being by far the more difficult. To accomplish this, the stem is to be held lightly in the right hand; then make the ball revolve by twirling it between the thumb and forefinger of the left hand, and when its motion becomes steady, throw it up with a slight jerk of the right wrist, and as it descends endeavour to catch it in one of the ways just mentioned. Calculate well the length of the string in throwing up the ball, so that it is not thrown to the full length of the string, or it will be almost impossible to succeed in catching it.

CUPOLETTE.



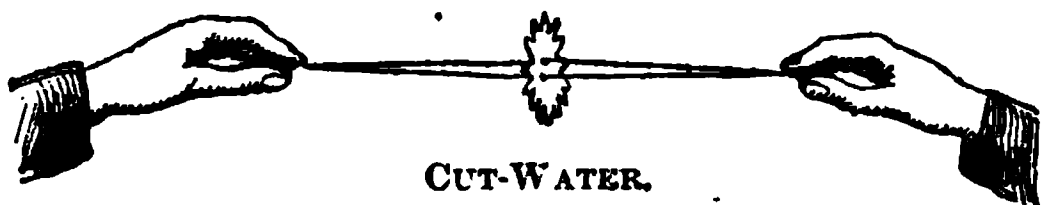
CUPOLETTE.

Although its warmest admirers will hardly maintain that the game of Cupolette requires much skill, yet it succeeds in affording considerable amusement. The materials for the game are a board with a number of sunken and differently numbered cups, a ball for each cup, and a movable arm, which is attached to the board, and from which a ball, heavier than the other balls, is suspended by a cord. To start with, the balls must be placed in the cups; the first player then turns the arm to any position he prefers, draws the suspended ball out to the full length of its cord, and allows it to swing back, so as to strike one or more of the balls out of the cups. Each ball knocked out scores one point; a ball struck out of one cup and into another scores the number of points indicated by the number of the cup; a ball struck off the board is lost and

scores nothing. Each player is entitled to four strokes, and each player, as it becomes his turn to play, replaces all the balls as at first, and proceeds as above. A game is usually either sixty-one or a hundred and one, according to the number of players. Sides may be formed if it is desired.

CUT-WATER.

The toy known as the Cut-Water is made in the following manner:—Cut a circular piece of tin or sheet-lead, three inches or so in diameter, into the form of a circular saw; bore two holes in it along the diameter at about an inch apart; through these holes pass the two ends of a string, tie the ends of the string together, and the toy is made. To use it, the string is to be taken up in the two hands, the metal saw being allowed to hang loosely at the middle of the string, and then thrown round and round until the string becomes very tightly twisted.



Upon the hands then being drawn outwards, the string untwists, and the metal saw rapidly revolves. So soon as the string is all untwisted, the hands should be allowed to go slightly nearer each other, when it will be found that the Cut-Water will revolve in the opposite direction. Again, when the string has become once more twisted, the hands should be drawn outwards, then inwards, and again outwards, and so on alternately. The name of "Cut-Water" is derived from a common way of playing with the toy. It is dipped a little below the surface of water whilst being spun, and it then sends showers of spray towards the player who spins it, or away from him, according to the direction in which it may be spinning.

An imitation Cut-Water may be more readily, and indeed often is, made by passing a piece of string through two of the holes of a common breeches' button, and treating the toy so made as explained above.

DANCING HIGHLANDER.

The Dancing Highlander, like the Apple Woman and a few other imitations described among the toy games, is really a hand performance supplemented by a few accessories. For the performance of the Dancing Highlander, get an old glove and cut off the tops of the first two fingers down to about the second joint; next will be required a very small pair of baby's socks, which are to be painted some plaid pattern, and fitted to the first and second fingers. Draw on the glove, then pull the socks on the first two fingers, padding out that for the first finger so as to be equal in length to that for the second. The figure of a Highlander in his national costume, which should have been first prepared out of cardboard and appropriately coloured, is then to be pasted on to the back of the glove; the tops of the two first fingers of the gloves should do duty for shoes, and the uncovered portions of the performer's fingers will show as the bare knees of the kilted Scot, who may then be made to dance or perform any of those wild antics usually attributed to the Highlander when his foot is on his native heath.

DANCING PEA.

A common pea, two small pins, and a piece of the straight stem of a broken clay tobacco-pipe, are the requirements for making this curious little toy. Run the pins crosswise through the pea, and cover their points with a little bit of sealing-wax, to prevent mischief in the event of the pins striking any one's

face. Put the point of one of the pins down the stem of the tobacco-pipe, so that the pea will rest thereon. Place the other end of the pipe in the mouth, holding the head back and the pipe stem perpendicularly. Upon then blowing steadily the pea will dance amusingly in the air.

DART AND TARGET.

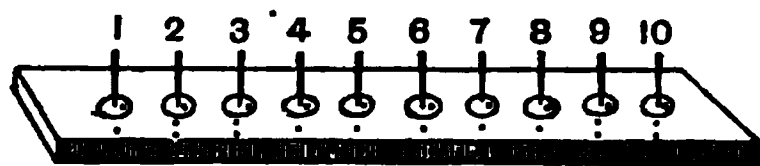
The apparatus required for this game is easily made. The dart is a straight piece of stick, about six inches long, with a pin stuck in at one end, and a paper guide at the other. The pin, which should be an ordinary large-sized pin, must have the head removed, and be pushed into the end of the stick, with the point outwards, and then secured in its place by a piece of twine or sealing-wax. The guide is made of a square piece of paper folded twice from corner to corner, and then inserted in cross slits made at the opposite end of the stick. The target is best if made of a piece of soft wood board, and should have painted on it three or four concentric circles of different colours, with a bull's-eye in the centre. The darts should then be thrown at the target from some distance to be agreed upon, and scores made according to the nearness of the darts to the bull's-eye. Each circle should be differently numbered, the outer circle counting one, the next two, and so on, an extra allowance being made for the bull's-eye.

DARTELLE.

This is the name given to Dart and Target at the toy shops. It makes a pretty toy, and combines in itself both darts and duly marked target, with the necessary instructions for play.

DECIMAL GAME.

Get a long piece of board and fix into it ten pins in a row. On each pin place a ring, and the game then is to make the ten rings into five pairs of rings in five



DECIMAL GAME.

moves, passing over two occupied pins with every move. The feat is to be accomplished in the following among other methods: Let the accompanying diagram represent the pins, board, and the rings as first placed thereon; remove No. 7 to No. 10, No. 6 to No. 3, No. 4 to No. 9, No. 8 to No. 2, and No. 1 to No. 5. The changes may be done in the reverse way, by commencing from No. 4 to No. 1, instead of No. 7 to No. 10, and so on, and other slight variations may be introduced. The game may also be played with ten counters, or ten pieces of paper, on a table or board, and without any pins. Indeed, children are frequently seen playing the game out of doors with ten common stones.

Let the accompanying diagram represent the pins,



DEMON BOTTLE.

DEMON BOTTLE.

Cut a piece of pith of wood, or some equally light substance, into the shape of a small bottle, and at its base fasten the half of a small bullet (*a*, see figure). Down the centre of the bottle bore a hole, and fit the hole with a steel pin (*a b*). The bottle so made may be rendered obedient to the commands of its owner, who, when he wishes it to stand upright and resist the commands of the bystanders, will previously have removed the pin; when he wishes it to act in the contrary manner he will insert the pin, which will be found to counteract the weight of the

bullet, and the bottle will obediently recline after receiving its owner's orders to do so; the owner of course then being careful to give such orders.

DRAWING-ROOM ARCHERY.

See "Puff and Dart," "Dart and Target," and "Dartelle."

DUTCH RACQUETS.

Dutch Racquets, or the Dutch Top Game, is very similar to the game of Castle Bagatelle, or Cannonade. The appliances needed are somewhat expensive, and the description of how to play the game, with the rules by which it is governed, is supplied with the toy.

The game is played on a board fitted with metal barriers that are variously numbered, and on the different numbers miniature skittles are placed. A metal top is then spun at one end of the board, and as it travels, the skittles, or some of them, will be overthrown. The numbers covered by the skittles overthrown count towards game.

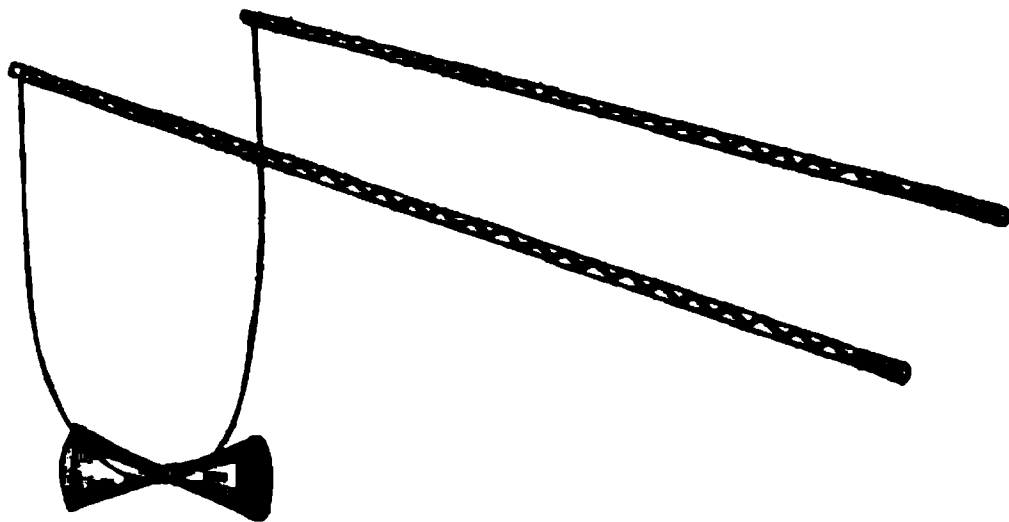
ENFIELD SKITTLES.

This is a game played on a level board with raised edges. Nine small wooden pins are arranged at one end of the board as skittles are arranged in the ordinary skittle-alley game. These skittle pins are then bowled at by means of a small ivory or boxwood ball, propelled with an ordinary billiard cue. The game is frequently arranged for on an ordinary dining-room table, precautions being first taken to prevent the ball from rolling off.

FLYING CONES.

Flying Cones are made of hard wood, hollow, a hole being made at one side so as to produce a humming sound when the completed toy is being spun. Two such cones are fastened together at the apex. The spinning apparatus consists of two

thin sticks, to the tips of which a string of about a yard long has to be tied. To play the toy, lay the cones on some flat surface, take one of the sticks in each hand, holding them at the opposite ends to those to which the string has been attached, slip the string under the cones, so as to catch them just at that point where they have been united, being careful that the toy is somewhat



FLYING CONES.

nearer to the right-hand than to the left-hand stick. Next, raise the sticks, at the same time making such a movement with the right hand as to set the double cone revolving on the string. By a sort of whipping movement, first with one hand and then with the other, it may be kept spinning; when quickly spun, it will make a humming sound, and with practice considerable dexterity in the use of this toy will be easily attained.

When the toy has obtained sufficient speed to commence humming, many pretty feats may be shown with it. It may be flung in the air, and as it falls

It may be caught on the loose or tightened string, or on one of the sticks, and made to roll towards one or other of the hands of the player. Two players, each being provided with the necessary sticks, with string attached, may keep a flying cone spinning a long time, and at the same time be continually throwing it backwards and forwards from one to the other. This toy is also known as *Le Diable*, and is usually sold in the toy-shops under that name.

FRENCH AND ENGLISH.

See "Slate Games."

GAS BALLOONS.

Small Gas Balloons are made of thin sheet india-rubber or gutta-percha, or tissue paper; larger ones are made of oiled silk. Cut gores of the material to be used sufficient in number when fastened together, the sides of each gore overlapping the gore fastened to it, to form a globe of the desired size with pear-shaped ends. Join the gores together, so as to make them completely air-tight; when the heavier materials are used they should be sewn together, and then covered with glue or thin varnish. At the lower end of the balloon insert a tube, and tie all the narrow tips of the gores firmly round it. Cover all with a solution made of india-rubber dissolved in naphtha and turpentine, and over the balloon place a net bag that has been previously made of the proper size and shape.

The gas with which the balloon is to be filled is made in the following manner:—Put a pound of granulated zinc or iron filings into two quarts of water in a stone jar, and add gradually a pint of sulphuric acid. Have a tube of glass or metal run through the bung with which the jar is corked, and after taking the materials out of doors, fill the balloon by connecting this tube with the tube already placed at its mouth. When the balloon is filled, tie its neck very tightly, and it will rise into the air. Common coal-gas may be used when it can be obtained. A small car made of some light material may be attached to the netting which goes over the balloon.

Soap-bubbles inflated with gas may be made in the following manner:—Fill a bladder with hydrogen gas, adapt a tobacco-pipe to the mouth of the bladder, and dip the bowl of the pipe into soap and water; then press the bladder, and bubbles will be duly formed, which floating away will at once rise in the air.

Toy balloons ready to be filled with hydrogen gas may be now purchased at many toy-shops, or of philosophical instrument-makers.

GERMAN BALLS.

Luck and skill combined in about equal degrees make the principal charm of this game, which is a very simple one and in many respects resembles the game of marbles known as "*Die Shot*."

The game may be played equally well in-doors on a carpeted floor or out of doors on a lawn, or any other level surface. The materials required are a number of balls, and a larger ball shaped as a die with eight sides, numbered respectively 1, 2, 3, 4, 5, 6, 7, and 8. The die is placed on the ground with the figure 8 downwards, and the players, each being supplied with a ball, bowl alternately at the die from some point at a distance from the die to be agreed upon. If the die is missed, nothing is scored, and in some places the player who misses pays one to a pool. If the die is hit, the player whose ball hit it scores the number on the side of the die which remains uppermost.

Under some rules each player puts a stake into a pool, and he who attains the highest score in a certain number of throws wins the pool. If, however, any

player should succeed in turning the die so that the number 8 remains uppermost, he takes the pool at once, and a new game is then commenced.

GERMAN BILLIARDS.

This is a game played with balls on a board on which is a complicated arrangement of pins, hoops, holes, recesses, and cups, the holes, recesses, and cups in which are variously numbered. The balls are propelled by means of a spring fitted into one side of the board, and the scores are in accordance with the numbers marked in the respective holes, recesses, and cups that the balls fall into after wandering through the many pins and hoops that are fixed all over the board.

HAT MEASUREMENT.

GERMAN BILLIARDS.

The practice known as Hat Measurement has sprung up owing to the fact that very few people either have but very little idea of the probable height of very common objects, or if they know the actual height in inches of those objects, are unable to demonstrate that height. The judgment is very frequently tested by asking the company present to mark on a wall about the height of an ordinary chimney-pot hat; and in the majority of cases, upon a hat being actually brought in, it will be found that the height marked is sufficient for at least a hat and a half.

HOMeward BOUND.

See "Patchesi."

HYDRAULIC DANCER.

Make a little figure out of a piece of cork, pith, or some equally light material; place in the figure a small hollow cone of thin leaf brass; then set the figure on any water-jet or small fountain, and it will remain suspended on the top of the water, and will jump, dance, and move about in a very amusing manner. A hollow ball of thin copper, placed on a jet or fountain in a similar way, will remain suspended, turning round and spreading the water gracefully about it.

IMMOVABLE CARD.

Upon the face of it, and on first thoughts, it would appear to be the easiest possible thing to blow over an ordinary visiting card placed on a table, provided it be not secured in any mechanical manner. If a visiting card is neatly turned down at the narrow edges, about a quarter or a third of an inch, so that the edges turned down are at right-angles with the remainder of the card, and the card be then placed on the turned down edges, the feat would seem to be still more easy than if the card were simply placed flat on the table. The contrary, however, is the case, and unless let into the secret one may blow at a card so placed for hours without being able to overturn it.

To accomplish the feat, the blowing must be done on the table, not on the card, and at some distance from the card.

INDIAN SKITTLE POOL.

See "Skittle Cannonade."

JACK-IN-THE-BOX.

The toy known as Jack-in-the-Box is familiar to all, and is always the source of much fun; it may be readily made by any ingenious lad who will carefully follow the accompanying description:—

The toy consists of a box containing a figure of some comical shape. Inside the figure a piece of wire, known as the spring, is coiled up, corkscrew-wise, like the spring within a carriage candle lamp. The box should be made so that when the lid is closed the wire or spring within the figure is compressed; on the removal of the pressure from the lid the wire regains its original form, and out springs the figure. The figure is sometimes secured to the bottom of the box, and sometimes attached to the side by a long piece of string, and then when the lid is suddenly unfastened, Jack will spring out of his hiding-place and fly up high into the air.

JAPANESE FAN.

See "Magic Fan."

JERK STRAWS.

This is a rough version of the game of Spillikins, or Spellicans, more fully described further on. Jerk-straws, Jack-straws, or Juggling-sticks, as they are indifferently called, are a number of small rounded sticks, forty or fifty or more, about twice as long and of the same thickness as a common Tändstickor match. These are thrown loosely in a confused heap upon the table, and the players have to remove them, one by one, by means of a longer stick, hooked or pointed as desired,

without, in the process of removing one stick, touching or disturbing any other. The first player removes as many as he can in this way, but as soon as he disturbs any other than the one to be removed, in the slightest degree, or touches any other one, he gives place to the next player, and so on. At the end of the game, the player has won who has secured the largest number of sticks.



Fig. 1.



Fig. 2.



Fig. 4.



Fig. 3.



Fig. 5.

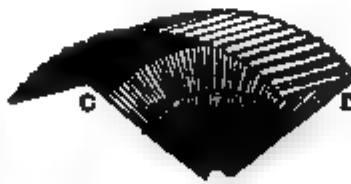
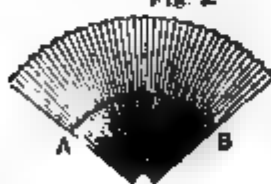


Fig. 7.

MAGIC FAN.

hard. As a toy, however, to be made at home, it is well worth something more than a mere superficial acquaintance.

LE DIABLE.

See "Flying Cones."

MAGIC FAN.

The description of several paper toys appears in this section of the book, but of them all the Magic Fan is the most ingenious, its varieties being so numerous. It is known by the names of the "Magic Fan," "Japanese Fan," "Puzzle-Wit," and "Trouble-Wit," and is often exhibited for profit in the public streets of populous places by members of that class of people who prefer living by their wits to working

In its manufacture a piece of good stout paper will be required, in size twenty-four inches by nineteen, or proportionately larger or smaller. The paper is to be measured into six equal parts, the divisions being marked on the margin, as shown in Fig. 1. Double the paper in half, as shown in Fig. 2. Fold the uppermost half outwards, making the fold as shown in the same figure by the letters A A. Turn the paper over and fold the other half in precisely the same way, thus making the paper as shown in Fig. 3. Upon examining the edge A A A, two openings between the folds will be seen, whereas

Fig. 12.

at the edge B B B, three openings will be found. The hand has next to be inserted into the middle of these latter openings, and the paper folded outwards to the right and left, and turned over, when it will show as in Fig. 4. Then pinch the paper from end to end in plaits like a ruff, three-eighths of an inch in depth, so that when it is all pinched it will be in small compass, as in the Fig. 5. The Magic Fan is then complete, and all that remains is to learn how to produce its variety of shapes. It is said that as many as from sixty to seventy varieties have been produced; a few only will, however, be here indicated, as by attention to the directions now given it will be a comparatively easy matter to ring the changes on the kinds specified. It must always be remembered that every time the form of the fan is changed, the paper must be again well pinched together, in order that the folds of the plaits may remain plainly and strongly marked. Unless the folds are kept in order the fan cannot be properly worked.

FIG 17.

MAGIC FAN.

FIG. 18.

To produce the first form, the common-shaped fan, Fig. 6, catch the folded paper, Fig. 5, at the bottom with both hands, pinch it in and then spread out the top. For Fig. 7, insert the fingers at A and pass them round to B, raising the paper. To turn Fig. 7 into Fig. 8, insert the fingers at C and pass them round to D.

For the next change, catch the paper by the part now uppermost, pinch that part well together, and the paper takes the form of a scoop (Fig. 9), the upper part of the fan, Fig. 8, becoming the handle of the scoop. Pinch the paper again into the form of Fig. 5, lift up the upper part A, bring the lower plaits, B, well together, and with one hand arrange the upper part, so as to form the head of a mushroom (Fig. 10). A new form may be got by raising part of the double head of the mushroom. For Fig. 11, reverse the paper and spread out the lower part, so that it may represent the body of a wine-glass, that which in Fig. 10 was the head of the mushroom will soon appear as the foot of the glass. To make the Chinese lantern, Fig. 12, open out all the paper and twist it round; catch it now by the central part, and by compressing the central folds well

together, something like two of the enormous wheels of a steam stone-crusher will be produced (Fig. 13). The butter cooler, Fig. 14, is obtained by opening the paper out again and catching it at the two ends.

The original form, Fig. 5, must then be again reverted to, and a fresh start may be made by catching the paper at both ends and folding it so as to represent Fig. 15. By drawing it out the table mat, Fig. 16, will next be shown. Raise up the paper at the letters A and B of Fig. 16, and there will appear a dish in the form of Fig. 17. Fig. 18 is obtained by then pressing the paper inwards. The sentry box, Fig. 19, comes by drawing the paper out, and letting it loose at the foot. And so on, many shapes not here set forth may be obtained.

Experiment freely on the Magic Fan; if spoiled it costs nothing but a little patience and a few minutes of time to re-make, and a dexterous lad will produce staircases, sofas, chairs, flower-pots, windows and window-blinds, nightcaps, boxes, &c. &c. &c.



MAGIC FIGURE.

MAGIC FIGURE.

This is an amusing and easily made toy. Its peculiarity lies in this, that however it may be knocked about, so long as it remains whole, it rises of its own accord to its feet and retains its balance with a gently swaying motion. The figure should be cut out of cork or pith, or something equally light, and may be clothed by gumming on to it some silk floss or other similar substance; to its base, but hidden as much as possible, should be fastened the half of a leaden bullet, with the semi-circular side undermost. The weight of the pedestal will then be sufficient to secure the recovery of the figure immediately after being made to lie prostrate.

It will be seen by reference that the principle underlying the manufacture of this toy is similar to that of the Demon Bottle, previously described, the variation being the steel pin in the bottle which, when inserted, counteracts the effect of the weight adjusted to the base of the figure.

MAGIC FLUTE.

The magic flute is to be made out of a good sound and unused cork, which has in it neither holes nor cracks. Place the cork against the teeth, holding it tightly between the lips, and play upon it with the handles of two prongs or forks or the bowls of two spoons. An imitation of the piccolo or small flute will thus be produced, and almost any simple quick air may be played upon it.

MAGICIAN OF MOROCCO.

The Magician of Morocco is a hand performance similar in character to those described under the headings of the Apple Woman and the Dancing Highlander. He is made (see Fig. 1) by holding up a hand, bending down the third and little fingers, placing the thumb in front, holding the first finger straight up, and the middle finger slanting half-way between the first and third fingers. The top joint of the first finger is to be dotted to represent a face, and on the tip of the finger a handkerchief, knotted at one corner to represent a cap, is to be placed, the remainder of the handkerchief being draped about the



Fig. 1.—SKELETON OF THE MAGICIAN.

hand to do duty for the robe (see Fig. 2). This robe looks more effective if the handkerchief out of which it is made is of some bright colour or colours; an Indian silk handkerchief makes both a capital robe and cap combined; the cap may, indeed, then be easily made to look very like an ordinary Turkish fez.

It will thus be seen that while the first finger in the hand does duty for head, shoulders, and bust, the middle finger, when the whole figure is held sideways to the company, shows as the arms, and the body is made full by means of the position of the thumb and other two fingers.

It is necessary that the Magician of Morocco should have some long outlandish name, and to ensure his success that he should be very voluble with quackeries, divinations, tricks, jests, prophecies, conundrums, scandals, and nonsense of every sort and description; his conversation being accompanied by judicious nods and twists of the head, as it will not be easy to impart much of a twinkle to his eyes.

MAGNETIC SWAN.

The Magnetic Swan, and other articles made in the same manner, will illustrate the properties of the Magnetic Wand. A number of such articles, to represent swans, ducks, small boats, &c., may be made and placed in a basin or tub of water, and kept in motion by a judicious use of the wand. Be careful to model the articles so that they may undoubtedly represent those objects they are intended to resemble.

FIG. 2.—THE MAGICIAN OF MOROCCO.

Swans, ducks, boats, and such birds and things as swim or float on the surface of water, should be made out of cork, pith, or light wood, with a small piece of magnetised steel run through the body. Swans should be covered with white wax, thinly spread over the body of the bird, and the ducks and boats should be treated in the same way, with the addition of being properly coloured afterwards. Glass beads for eyes may be placed in the heads of the birds. Some care in balancing and loading these objects will have to be taken to ensure their floating properly and steadily.

Fish may also be made in a similar way, but much nicety has to be shown to load them so as to sink them below the surface of the water, and yet to make them sufficiently buoyant to keep them from sinking to the bottom.

Toys of this nature are supplied at a small cost at most toy-shops.

MAGNETIC WAND.

A number of very pleasing experiments may be performed by means of the Magnetic Wand. It is made out of a rod of hard wood, about ten inches long by a third of an inch thick. A hole is to be drilled into this rod, and in the hole is to be placed a strongly magnetised steel wire. Two small knobs should then be placed upon the reverse ends of the wand, and, in order that it may be readily known which end of the wand is the attractive and which end the repellent point of the magnetised wire, the knobs ought either to be differently carved or one or both of them should bear some distinctive mark. The letters N and S are suitable as specifying the north and the south poles, by which terms the opposite ends of the magnetised wire are scientifically expressed. The wand so made is complete, and by holding one or other of its ends to the tips of small articles floating in water, made after the manner described in

the manufacture of the Magnetic Swan, such articles may be made either to follow after or swim from the wand according as it is the north or the south pole which is held out.

It is an easy matter to magnetise a bit of steel wire, and under this heading of how to make a Magnetic Wand, a few hints on magnetising common objects of steel and iron will not be out of place.

An ordinary poker may be magnetised in a very simple manner. Hold it in the left hand, pointing it somewhat inclined from the perpendicular, so that the lower end is towards the north, then strike the poker several times smartly with a large iron hammer, and to a slight extent it will then be found to possess the powers of a magnet. Another method is as follows:—Get an old large iron poker, and a similar pair of tongs, such as may be found forming a part of the set of fire-irons formerly supplied for kitchen use. Fix the poker upright, and hold to it a bar about three inches long of soft steel, which should be about a quarter of an inch broad, but not more than a twentieth of an inch in thickness. Make on one end of the steel a mark, and let that end be held downwards. The steel should not be held to the poker with the hand, but should be suspended on a piece of silk held in the left hand, and so suspended as to touch the poker. Then grasp the tongs a little below the middle with the right hand, and keeping them as nearly vertical as possible, rub the steel bar with the lower end of the tongs, from the marked end of the bar to its upper end about ten times on each side of it. By this means the bar will receive enough magnetism to enable it to lift at the marked end a small steel key. Or if the bar so magnetised be suspended at its centre, and made to rest on a point, the marked end will turn to the north.

Steel fireirons which have remained untouched during the summer period, and have at the same time remained resting on the fender, in an ordinary living-room, will be found after a few months to have become possessed of magnetic properties.

A common sewing needle is readily magnetised by passing, when gently pressed against it, the north pole of a magnet from the eye to the point of the needle. After the end of the needle has been reached, the magnet must not be passed back along it again to the eye, or the effect will be destroyed; but the effect is increased if the magnet is passed several times in succession from the eye to the point. A needle so magnetised may be used in the place of the magnetised wire required for a small Magnetic Wand.

MAGNIFYING PINHOLE.

See "Microscope (Toy)."

MECHANICAL BUCEPHALUS.

See "Pegasus in Flight."

MICROSCOPE (TOY).

Toy microscopes, or miniature microscopes that may be easily made, are of two sorts. The first and simplest is sometimes called the Magnifying Pinhole. Take a blackened card, and make a hole in it with the point of a fine needle. Hold up the card, and look through the hole so made at any small object held at about an inch from the card, and the object so held will appear magnified about ten times. Remove the card from the eye, leaving the object looked at in its former position, and it will then not be seen at all; this is accounted for from the well-known quality of the eye that it is unable unaided to discover a single object not more than an inch away.

Another sort of toy microscope is made out of a thin plate of lead or brass. Bore a hole in it with a fine awl or a large needle, and let a drop of clear water fall into the hole so as to fill it up completely. Then place any object that it is wished to examine below the thin plate, and immediately below the globule of water. Look through the globule, and the object looked at will be seen, apparently magnified about a hundred and fifty times. A full water-bottle also has microscopic powers.

MOCKING CALL.

The Mocking Call is a little instrument by which one may imitate the song of birds, animals, and various other sounds, and is to be made in the following manner:—Cut a small square piece from the green leaf of a common leek, lay it on a table or clean board, and with great care scrape away a piece of the green pulpy substance of the leaf, being very careful on no account to injure the fine outer skin. Place the instrument so made in the roof of the mouth, with that side downwards on which is the outer skin. Press the instrument gently with the tongue into its place, and then blow between the tongue and the upper teeth. At first sounds will be emitted that will not readily be recognised as similar to those of birds or animals, but with practice and patience the barking of a dog, the neighing of a horse, or the notes of many of the song birds, may be successfully imitated. When the Mocking Call is not in use, it should be kept moist by placing it in a glass of water. This toy is useful when used in a ventriloquial entertainment.

MOORISH FORT.

The game of Moorish Fort is a good round game of skill. It is a comparatively new game, and is supplied by the toy-dealers, with rules, at a reasonable price; but as the materials to play the game with may be found in any tolerably extensive collection of toys if supplemented by a fort and a few rods, which can easily be made, some readers of this book may, if unable to purchase the materials, feel inclined to practise their ingenuity in adapting the toys they possess to play the game.



Fig. 1.—THE FORT.

A round fort, constructed in the manner shown in the accompanying woodcut (Fig. 1), is placed in the centre of an ordinary dining-room table. The players should number six or less, and be divided into two sides, each side taking opposite positions; each player should

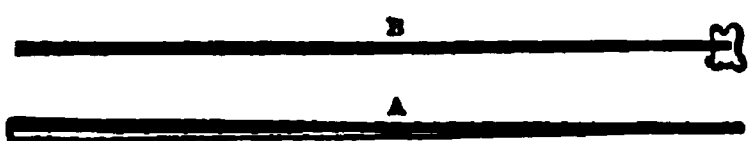


Fig. 2.—CUE (A) AND REST (B).

be provided with a small round ball (those supplied with nine-pins do admirably), and the player, armed with a cue about eighteen inches to two feet long (Fig. 2, A), should strike his ball towards the fort.

A rest for the cue (Fig. 2, B), with a piece at the end, of the same length as the cue should also be supplied, to facilitate the striking of the ball when at a distance from the player, as it is to be made a rule that no player may, when playing, place his hands or arms on the table. That side which first gets all its balls into the fort wins, but a code of rules may be drafted embodying these and other regulations at the pleasure of the players.

NAVETTE.

The game of Navette is played with a bridge having numerous arches, each one of which bears a distinctive number, higher or lower, according to the size of the arch and the difficulty of attaining

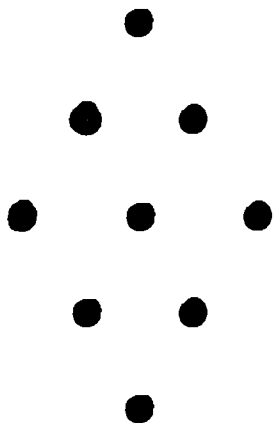


NAVETTE.

the object of the game, which is bowling discs, or small balls, at the bridge when placed on the floor or on the table, so that the balls may pass under one or other of the arches of the bridge. The players bowl alternately at the bridge, and he who makes the highest score in an agreed number of bowls of the ball wins. The arch-board used in marble games may be utilised for this game.

NINE PINS.

The toy-box containing Nine Pins, for playing the game of that name, together with the requisite number of balls, is to be purchased for a very trifling sum.



PLAN OF NINE PINS.

Inasmuch as both pins and balls have to be turned in a lathe, it is almost impossible for any lad with an ordinary chest of tools to make them for himself, and, indeed, the game of Nine Pins is not a game usually played at by lads of an age able to make their own toys—it is a very small child's game. The game is played in two ways, either by throwing or bowling the balls at the pins, or by attaching a ball to a rope or string suspended from the ceiling, and so swinging the ball at the pins.

The pins may be set up in any manner agreeable to the players, either in a line, circle, or in the same way as in the game of skittles, in the form shown in the diagram. The number of pins knocked down counts towards game, and the player who can knock all down in the fewest throws or swings of the ball wins.

NOUGHTS AND CROSSES.

See "Slate Games."

OBEDIENT SOLDIER.

A toy similar in principle to the Demon Bottle, previously described, is the toy known as the Obedient Soldier. He should be made of pith, cork, or some very light wood, should be carved with a soldier's busby and tunic, and have in his arms a rifle at the "shoulder arms" position. The barrel of the rifle must be made hollow, in order that in it may be placed, when desired, a piece of solid steel wire. The whole figure is to be fastened at the feet on to the flat side of the half of a leaden bullet. Upon the steel wire being inserted in the barrel of the rifle, the soldier will lie down, and upon its being removed he will stand upright. The secret of these actions should rest with the performer who shows off the ways of the Obedient Soldier, and it will be necessary, in order to preserve this secrecy, that some dexterity be exhibited in the placing or removing of the steel wire.



OBEDIENT SOLDIER.

PALADA.

The game of Palada is a game very much resembling that of Cup and Ball, and has become quite a popular amusement. The toy consists of a slim and tapering rod, the thick end of which is used as the handle, and at the opposite end is a piece of cane bent into an oval form. Attached to the rod, and at about a foot or a foot and a half from the oval end, a solid egg-shaped substance is fastened by a piece of string half as long again as the distance from the oval end towards which it is secured.

The object of the game is to catch the egg-shaped substance on the oval end of the rod, which is made large enough to allow of the egg finding a secure resting-place, but at the same time smaller than the egg, so that it may not fall through.



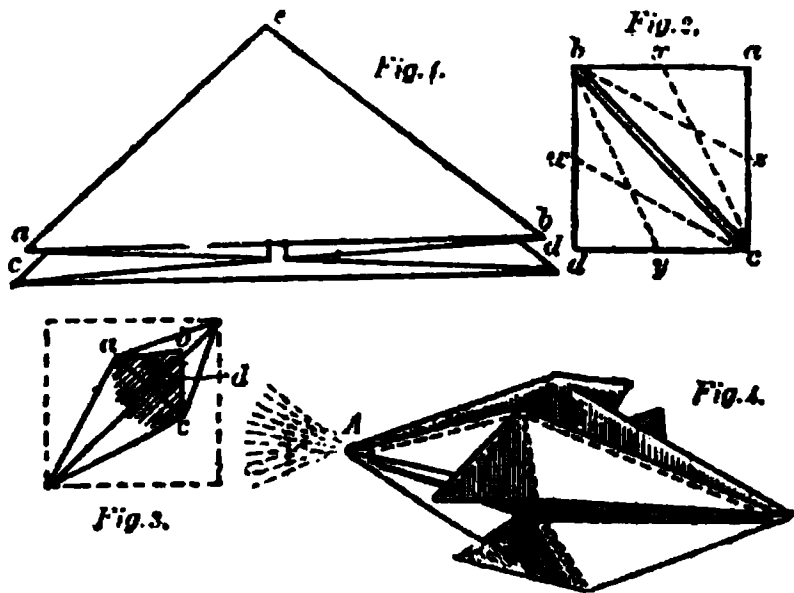
PALADA.

PAPER TOYS.

A very considerable number of toys may be constructed out of paper alone, and much amusement may be obtained in the making of such toys, as well as from the uses to which they can be put when made. The Magic Fan and kindred objects have been explained under that heading, and the following are a few other objects that, with a little practice, it will be found very easy for any one to make at pleasure.

Paper Bellows.—The first in the alphabetical list of paper toys is that known as paper bellows, and a very good imitation of a pair of bellows it will be found to be.

Get a piece of paper of the substance of an ordinary sheet of note-



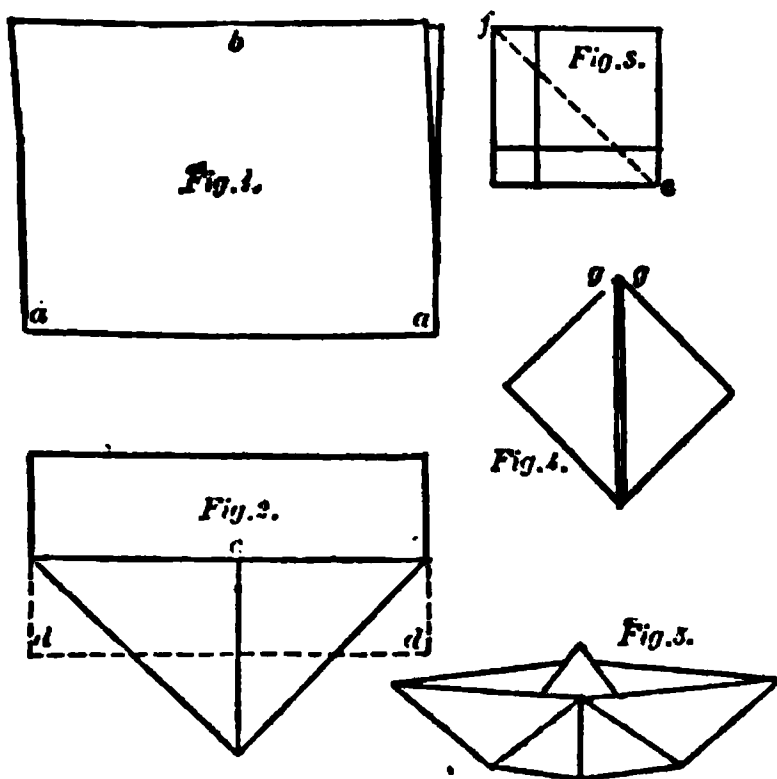
PAPER BELLOWS.

paper, cut it into a square each side of which is at least twelve inches long, and fold it double, by making two of the corners meet with the middle line stretching between the other two corners. Open the paper out and fold it again, by making the other two corners meet, and upon it being again opened out, the folds will be left in the shape of a St. Andrew's Cross. Turn the paper over, and holding two of the folds between the finger and thumb of each hand, press them inward, and press the paper quite flat, so as to make it take the form shown in Fig. 1. Make the corners *a*

and *b* meet at *e*; turn the paper over, and make the corners *c* and *d* also meet at the same point *e*. Turn the first side uppermost again, and the paper will show as in Fig. 2. Make creases in the paper, by folding *a* to *b*, *a* to *c*, *d* to *b*, and *d* to *c*; the creases should then show as indicated by the dotted lines in the figure, the paper being folded out immediately after each inward fold. Next pinch together between the finger and thumb those parts indicated by the letters *a*, *x*, *z* and *d*, *w*, *y*; pinch first the one, and then the other, and the paper will fall naturally into the form given by the folds, and will appear like Fig. 3; the dotted lines outside the figure representing the reverse side of the paper, the letters *a*, *b*, *c* forming the handle of one side of the bellows. Afterwards turn the paper over, and do with the other side as last described, by first folding the paper and then pinching it into shape; the handle of the other side of the bellows will so be formed, and the toy is complete, as represented by Fig. 4. The bellows are blown by alternately pulling out the paper by the handles and closing it again quickly, when wind will be found coming out of the bellows at the point marked *A*.

Paper Boat.—For this toy the size of the paper should be nine inches by six, or with sides of proportionate length. Double the paper as in Fig. 1; turn up the corners *a*, until they meet at *b*, when the paper will look as in Fig. 2;

turn down the two sides *c*, one to the one side, and the other to the other side, to the dotted line *d d*. Insert the thumb of each hand, and pull out the paper



PAPER BOAT.

so that it may take the form of Fig. 3; being careful in so doing to arrange neatly the corners *d d* of Fig. 2. Turn up the points marked *e* in Fig. 3, one to the one side, and the other to the other, till they touch the point *f*, folding at the dotted line of the figure. Insert the thumbs again, and pull out the paper to make the form shown in Fig. 4. Lastly, take hold of the paper with the finger and thumb of each hand at the points *g g*, and pull them gently outwards right and left, being careful not to press the inside, and the boat will be complete as in Fig. 5.

Paper Boxes.—Cut a piece of paper into a square of dimensions according to taste, or according to the size of the box required. As a first attempt a piece of paper about six or eight inches square will be found to be most convenient.

Make folds in the paper according to the dotted lines shown in Fig. 1, remembering that in making paper boxes the paper is never to remain folded, except in the last figure, and that the folds are merely to be looked upon as marks for future guidance. Then fold the corners *A B C D* into the centre, and the folds will show as in Fig. 2. Next fold over and unfold alternately, *A* to *H*, *B* to *F*, *C* to *I*, and *D* to *G*, after which the folds should appear as in Fig. 3. Then in the same way fold and unfold *A* to *N*, *B* to *M*, *C* to *L*, and *D* to *K*, when the dotted lines in Fig. 4 should each be represented by a fold in the paper.

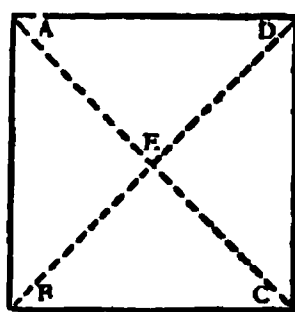


Fig. 1.

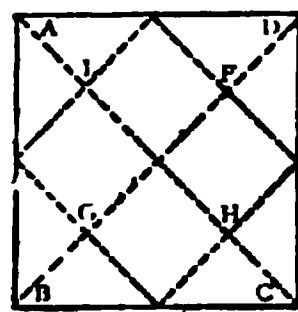


Fig. 2.

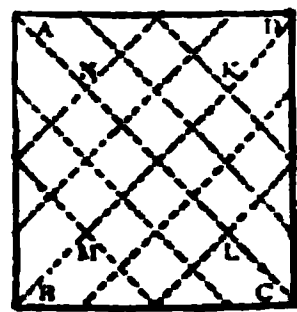


Fig. 3.

PAPER BOXES.

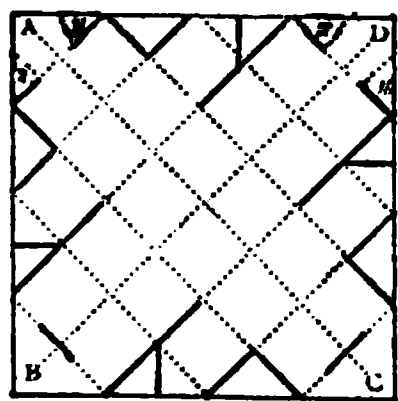


Fig. 4.

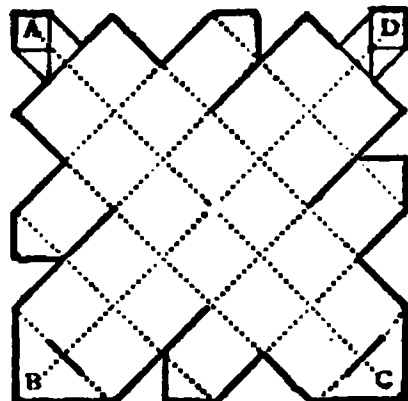


Fig. 5.

PAPER BOXES.

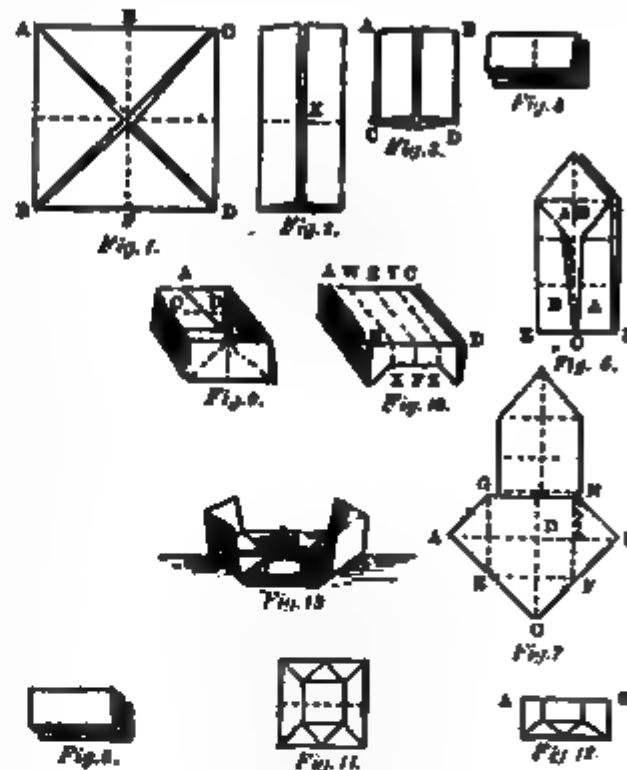
Take a pencil or pen and mark the paper in accordance with the black lines of Fig. 4, and cut with a pen-knife at all those marks, removing such pieces as will necessarily become detached. Fold and keep folded the short sides *x* and *y* of the corners *A* and *D*, so that they may pass easily through the slits in the opposite corners *B* and *C*. Lastly, and to finish the box, pass the folded corner *A* through the

slit in the corner *C*, then opening out the folds in order to make the fastening secure; pass the folded corner *D* through the slit in the corner *B* in the same way, and at the same time fold in the side that would otherwise overlap.

Paper Chinese Junk.—This paper toy is one of the most complicated and

difficult of all the paper toys to make; it requires for its explanation several diagrams, and in the making of it much patience. It takes as long to get into proper shape as it does to form many of the different varieties described under the heading of Magic Fan, and unless great care has been taken throughout there is great chance of the junk turning out but a poor affair after all. In spite of, nay in consequence of, the difficulties, however, it is worth attempting. Take a piece of paper about a foot square, and find its centre by cross folding it corner to corner; fold the four corners into the centre as in Fig. 1, and fold the sides *A B* and *C D* to the dotted line *E F*, so that Fig. 2 will appear. Keep the side of Fig. 2, represented in the diagram, outwards, and double the paper longways to form Fig. 3. Fold both the sides at *A B* of that figure to the points *C D*, and the small Fig. 4 will result. Open out again to make Fig. 2, and just under the middle of the outer flaps will be found the four corners of the paper; take two of those corners, one between the finger and thumb of each hand, and pull them out to make the elongated Fig. 5. Double the paper of that figure by the fold *A B*, so that the two points *C D* may touch each other back to back. The paper now appears as Fig. 6, and it is from here that great care and patience to complete the toy successfully will have to be shown. Take between the forefinger and thumb of each hand the two sides *A B*, and by pressing them outwards contrive so as to bring the line *A C* to be parallel with the line *C D*, and the line *B C* to the line *C D*. Into this position the paper must be folded flat, when it will be found to be in the form shown in Fig. 7. Fold the points *A B C* so that they will all meet evenly at the point *D*, and then fold the paper so that the line *E F* will be parallel to and upon *G H*. Turn the paper over, and treat the reverse side in exactly the same manner. Upon the exactness with which these Figs. 6 and 7 are dealt with depends the success of the endeavour, and if properly done the folding, when completed, should leave the paper as shown in the accompanying Fig. 8.

Insert the fingers then between the folds in that part, which will readily be found, where the paper may be easily pulled outwards right to left, when it will take a box form with overhanging flaps, as shown in Fig. 9. Place the two thumbs boldly on the tops of the two sides marked *A* and *B*, and press them firmly down to the table, making the folds inwards, as shown in the dotted line *C D*. Fig. 10 appears upon the box (Fig. 9) being then turned upside down; fold the line *A B* so as to produce the fold *W X*, and press the paper firmly down; fold the line *C D* to produce the fold *Y Z*, and again press firmly down. Turn the paper, and it should be fairly represented by Fig. 11. Double the paper outwards by the dotted line, and it will appear like Fig. 12. The test of accuracy in performance now appears. Take the points *A* and *B* of Fig. 12 between the forefinger and thumb of each hand, and pull carefully, slowly, and steadily outwards, forcing



PAPER CHINESE JUNK.

nothing; if thoroughly made the junk will come quite readily, and will appear bottom uppermost. Turn it over, and raise up the pieces of paper which will be found inside at each end of the boat to do duty as backs to the seats, and all is finished, and should appear as shown in Fig. 13.

In endeavouring to make this toy, keep well in mind that old, old couplet, that the elders are so fond of quoting to the youngsters for their encouragement and edification—

“ If at first you don't succeed,
Try, try, try again.”

Paper Dart.—The Paper Dart is one of the easiest made of the paper toys, and when made will last some time, if put only to its legitimate use. It is best made of a piece of good stout paper, which should be cut so that it is at least half as long again as it is broad. Double the paper length-ways, and make the fold *x z*, as shown in the accompanying figure, opening out the paper again; then turn up the two corners to meet at the points *a a*, and next turn the points *b b* to the point *c* in the same figure, when the paper should appear as indicated by the dotted lines in the figure. Again fold the paper, and retain it folded at the line *x z*; fold down the outside edges so that they are parallel with that fold, and open out the wings so made, and the dart is complete. To throw it, hold the paper on the line *x z* between the thumb and forefinger, take the necessary aim, and cast the dart; its motion through the air will be found to be accompanied with a graceful curve, and to make an accurate aim allowance must be made for the

PAPER DART.

curve. Boys sometimes amuse themselves by fighting sham battles with toys of this description.

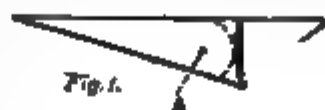
Paper Hat (Pyramidal).—The Pyramidal Paper Hat is to be made, so far as its initial stages are concerned, in just the same way as the manufacture of the Paper Boat is proceeded with, which is fully described in its proper place. The size of the paper out of which the hat is to be made must be decided by the size of the hat required. To make it, proceed as in the manufacture of the Paper Boat, and when the paper is in the form represented by the dotted line in Fig. 2, illustrating that toy, stop short, and turn in the corners of the paper corresponding with the dotted line in the figure, and the Paper Hat will be finished.



PAPER HAT.

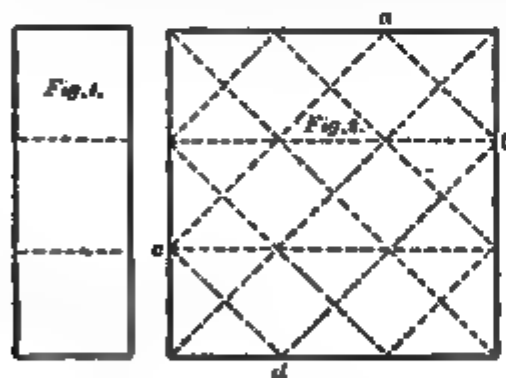
Paper Parachute.—To make a toy paper parachute, take a square piece of tissue or other light paper, and fold it from corner to corner into a triangular shape, fold it again from corner to corner, and again a third time fold it in the same way, and then double it so as to give it the appearance shown by Fig. 1 in the accompanying diagram. Cut with a sharp penknife through all the folds of the paper, shown by the dotted lines, and pierce a hole at the point marked *A* quite through; then, when the paper is opened out, it will be found to be as shown in Fig. 2. Fasten threads, all of which are to be of the same length, through each hole;

bring the loose ends of the thread to a point, fasten them there together, and attach to them a piece of cardboard or folded paper as ballast. The whole toy will then be complete, as shown in Fig. 3. If the parachute be then taken into the open air, and when a good breeze is blowing, the air will soon catch under the toy and carry it up to a considerable height. In the absence, however, of a wind, it requires some dexterity to set the parachute off successfully, and it may be much aided by the use of an arrow and a common bow. A small hole is cut in the top of the paper, in which the point of an arrow is inserted and fixed to the end by a little paste or gum. The ends of the thread should then be tied at about half-way down the shaft of the arrow, and, when complete, it will have very much the appearance of a closed parasol (see Fig. 4). If the arrow is then placed on the string of the bow and shot into the air, the parachute will on coming down open out and sail away gracefully, and more or less swiftly according to the current of air into which it may be propelled from the bow.

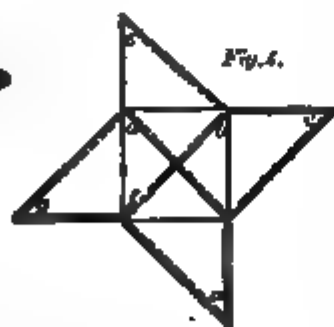


PAPER PARACHUTE.

Paper Purses.—Paper Purses are somewhat complicated in their manufacture, and when made are not the most serviceable of receptacles for money. As an exercise of ingenuity and care in the making they are worth attempting. Cut a piece of paper, tolerably soft and pliable, into a square, fold it into three equal parts, and when so folded again fold three times (Fig. 1); the paper now should again take the square shape, but much reduced in size. Take the paper when so folded between the forefinger and thumb of each hand, and pinch it into the star-like form shown in Fig. 3. Then open out the paper as at the beginning, being careful not to press it flat, but to retain clearly the marks of all the folds, which should be impressed as shown in Fig. 2. Catch the opposite corners at the points *a* and *b* and *c* and *d* respectively between the fingers and thumb of each hand, and by gently twisting and screwing the paper, humour it so that the folds will arrange themselves and leave the paper as shown in Fig. 4. Turning now to Fig. 4, fold the point *a* to the point *b*, *c* to *d*, and *e* to *f*, which should then leave the paper as shown in the Fig. 5. Insert the point *g* of that figure into an opening that will be found between the points *h* and *i*, and the purse, properly closed, is complete.



PAPER PURSES.



The chief of the paper toys made by merely folding the paper have now

been described; there are doubtless many other simple ones that need no description, and it has not been considered advisable to enter into the details as to the many simple toys that may be cut out of stiff paper or cardboard. Light-fingeredness, guided by a very small quantity of ingenuity and inventive powers, will suggest the uses to which cardboard may be put as an in-door amusement in the manufacture of sundry toys and other miniature articles. A very nice suite of doll's furniture may be readily cut out of pieces of stiff cardboard.

PARLOUR BOWLS.

This is an interesting game, adapted for any number of persons, and in principle is very similar to the game of Bowls, as described at large among the Lawn Games. The balls are, of course, very different in size to those used out of doors, and are made and adapted for in-door play. Each player is provided with two balls of the same colour, which he bowls towards a jack or die, the jack being placed at the side of the room opposite to that from which the players are stationed. The players decide the order in which they play, and then each one alternately bowls one of the balls towards the jack, and he who succeeds in placing his bowl nearest to the jack wins the game. When the players are more than three they may be divided into opposing sides, and it is then legitimate to play so as to knock an opponent's bowl away from, or a partner's bowl near to, the jack; scores should then be calculated after each round, according to the various distances that the bowls are from the jack. The game described in this book as German Balls is sometimes also known as Parlour Bowls.

PARLOUR CROQUET.

There are three versions of the lawn game of Croquet that are played in-doors, and are known as Carpet Croquet, Parlour Croquet, and Table Croquet respectively. These are all recently introduced games, and are deservedly popular. The mallets, balls, and arches are made of different sizes and shapes according to the game; they are all more or less similar to those used in the out-door game, and may be obtained, with the necessary rules, which are only adaptations of the rules of the out-door game, of the toy-dealers. Each version of the game may be played by eight or any less number of players. The peculiarity of *Carpet Croquet* is, as its name implies, that it is played on the carpet, and the hoops used are fitted into flat metal stands, so that the balls roll over the stand without hindrance. *Parlour Croquet* is played on a mahogany board lined with cloth, which is made level by means of adjusting-screws fitted underneath. *Table Croquet* is played on an ordinary dining-table, and with the other materials for playing the game are supplied cloth cushions to place round the edge of the table to prevent the balls from rolling off.

PARLOUR QUILTS.

An in-door game played with rings very similar to those used in the lawn game of Quoits is known variously as Parlour Quoits, Annulette, and Ringolette. The game bears but slight resemblance to the out-door game of Quoits, but is more nearly allied to that of Ring the Bull, of which a brief description will be found on p. 824.

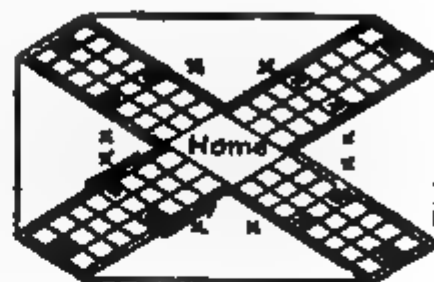
The game is one of skill, and is adapted for any number of players; it is played on a round board, or sometimes on an inclined plane. On the board nine pins, pegs, standards, or skittles of various colours, or differently numbered, are fixed, and the game consists in the players endeavouring to throw each of nine rings—coloured or numbered, as the case may be, to correspond with the pegs—on to its appropriate peg, each player counting towards game the number of the rings successfully thrown upon the proper pegs. Penalties are incurred by

lodging a ring on any peg other than that to which it is proper. Each player alternately should throw all the nine rings.

PATCHESI, OR HOMEWARD BOUND.

This is one of the many varieties of the Race Game, described more in detail under that heading further on; the game of Homeward Bound differing in that it should be played by four persons instead of an indefinite number, as in the ordinary race game.

Each player is provided with dice and dice-box, or, if it be preferred, the game may be played with a common numbered tætotum. The board on which the game is played is arranged as shown in the accompanying diagram, and three pieces or men are allotted to each player, who—according to the throws of the dice, and subject to such laws as have been laid down, or as may be laid down by the players—has to move these men first along the two outer rows of squares up towards home, returning the reverse way, and ultimately up the centre row to home. Whoever first reaches home wins the game.



PATCHESI.

PEGASUS IN FLIGHT.

This is one of the few balancing toys which may be readily made, and which will afford much amusement to all, and wonder to those who have not taken the pains to understand the principle on which it is constructed. It furnishes a solution of a popular mechanical problem or paradox, viz., "*how to prevent a body, having a tendency to fall by its own weight, from falling, by adding to its weight on the same side on which its tendency is to fall.*"

The Pegasus in Flight when complete is fairly represented in the accompanying illustration. It should be made out of a small toy figure of a horse in which the centre of gravity is found in, or very near to, the middle of the body. The wings, which are merely added for the sake of adornment, and to make the toy resemble in appearance the fabled charger after which it is named,

PEGASUS IN FLIGHT.

should be attached to the figure at a point just behind the shoulders; the wings should be of equal weight and so adjusted as to keep the balance of the figure true. They may, however, if desired, be entirely dispensed with, or any other addition, according to fancy, may be put upon the horse's back. A wire bent to a curve, to the end of which a small leaden ball has first to be attached, is to be fastened to the middle of the under part of the horse. Upon the hind feet of the horse being then set at rest on the edge of a table, and in such a position that the

lead ball is beneath the edge of the table, the animal may be made to rock to and fro without any fear of its being upset, and the longer the wire, provided only the proper curve is given to it, the longer will be the distance that the toy will sway upwards and downwards. This toy is also sometimes known by the name of the Mechanical Bucephalus, but it should then be made minus the wings, as is also the case when it is simply exhibited under the still more common description of the Prancing Horse.

PITH DANCER.

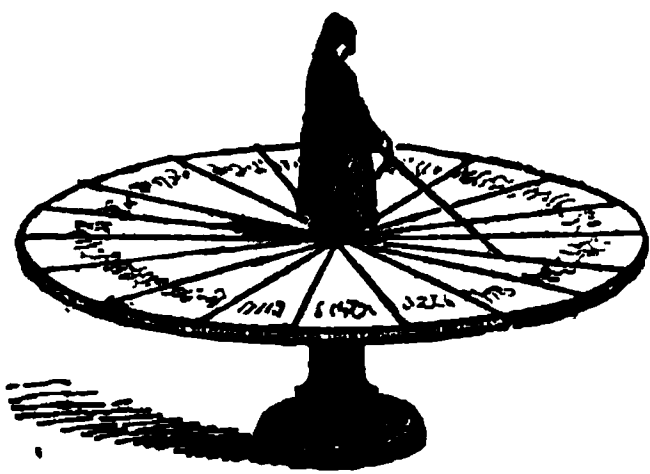
The Pith Dancer is a very pleasing dancing toy, and possesses the great merit of being easily made. It is a little figure made of cork, pith, or some other equally light material. At one end of the substance cut out a head and bust, and at the other end stick in four hog's bristles of equal length, so that the figure will stand erect thereon. To make the figure effective in appearance, paint the face, put a little cap on the head, add a pair of arms, and dress it in a cloak which may be made of some light stuff like tissue paper. When the figure is completely made and equipped, stand it on the bristles upon the sounding board of a piano, and play some brisk and lively tune. The vibration of the piano will then make the figure dance with much spirit, vivacity, and originality.

PRANCING HORSE.

See "Pegasus in Flight."

PROPHET.

The Prophet, or Sybil, as it is sometimes called, is a toy affording much amusement and diversion for the youngsters during the winter evenings. By its aid fortunes may be told and predictions as to circumstances of the future made with great confidence, for if the predictions should happen by any chance not to come true, the whole responsibility can be readily cast upon the Prophet. The toy is easily made, and by varying the table of prognostications the Prophet's opinion on an almost endless variety of topics may be taken.



THE PROPHET, OR SYBIL.

To make the toy, cut a piece of pasteboard, a few inches in diameter, into a circle, and ornament the edges with some pieces of fancy paper. Then mark on the white surface of the pasteboard twenty equal divisions, by means of lines radiating from the centre, and within each division place a number ranging in order from one to twenty. The figure of the Prophet should be made so that he has a venerable and sedate appearance,

should be clothed in a robe reaching to his feet, and he should hold in one hand a small rod for a wand, which is to be made pointing downwards. The figure may perhaps be purchased, but it is better that it should be made, as it may then be more readily adapted to the taste or fancy, and it can be easily cut out of wood, cork, cardboard, or some other material. It will add much to the general appearance if the Prophet be supplied with a loose white beard.

When the card and figure are finished, the card is to be mounted upon a small wooden stand, through the centre of which a steel wire is placed, and the figure of the Prophet is to be fixed on the wire in such a manner that it may revolve freely.

The next thing to be done is to draw up a table of prognostications, which must equal in number the spaces marked upon the cardboard disc. This may be

done in many ways. Sometimes the company present may be requested each to supply a set, or to supply alternately one of a set; or it is better, perhaps, that he who is about to show off the oracle should previously have supplied himself with several sets, one of which, of course, must only be used at a time. The sets should be so arranged that each one is complete in itself, and the various prognostications in a set should bear some sort of relation one to the other.

When all is ready, the performer should desire some one of the company to have his or her fortune told. The prognostications to be used are then to be handed to some other person, and the figure of the Prophet is to be set spinning, and according to the number of the division at which the wand of the Prophet points when it comes to a standstill, so, according to the prognostication bearing the corresponding number, may the fortune of the inquirer be expected to be.

The following prognostications may either be used, or may serve as models upon which tables can be drawn up :—

- 1.—At the end of a changeful life, wealth.
- 2.—Early and prosperous marriage.
- 3.—Great success at school.
- 4.—A speedy and important journey.
- 5.—Will spend much time from home.
- 6.—Hours of pleasure, followed by years of care.
- 7.—May expect to be thwarted.
- 8.—Will have invitations to numerous parties.
- 9.—All work and no play makes Jack a dull boy.
- 10.—Travels by land, and voyages by sea.
- 11.—Many changes will be your lot.
- 12.—It will be your misfortune, not your fault.
- 13.—A hearty playmate and a constant friend.
- 14.—Changes in love at an early date.
- 15.—A long life and a merry one.
- 16.—Fears from a rival, but success ultimately will be yours.
- 17.—Beware of a false friend.
- 18.—Bright and cheerful in youth.
- 19.—Unhappy ere long, but the sunshine will follow in the end.
- 20.—Your present sweetheart will not be your mate.

It will be seen that some of the above are very definite, but it is generally advisable that the prognostications should be vague, and capable of more than one interpretation, or the infallibility of the Prophet is likely not to be implicitly believed in. The Prophet is a very useful toy to introduce into a drawing-room entertainment for children, especially where he is not known (and he is not frequently met with); a few sets of prognostications will prove a source of a good half-hour's fun with a lot of inquiring youngsters.

PUFF AND DART.

The game of Puff and Dart is very similar to that already described under the heading of "Dart and Target," and is one of the games included by many under the more general description of Drawing-room Archery. The dart is made in the same manner, but of a smaller size, as is the dart used in the game of Dart and Target, but instead of being thrown from the hand towards the target as in that game, it is in this propelled through a small tube by a puff of the breath. The target is precisely similar to the target used in the sister game.

Darts shot by the breath through tubes are favourite weapons of offence among certain Indian tribes; they, however, first dip the tip of the dart in some poisonous substance, and then send it at the enemy. It is a deadly weapon, and the tribes using it are very skilful both in their aim and in the force with which the weapon is despatched.

PUSH PIN.

The game of Push Pin is certainly a game that does not require a vast amount of ingenuity or intelligence to indulge in with success. It is very contemptuously described in Strutt's "Sports and Pastimes" in the following language:—"Push Pin is a very silly sport, being nothing more than simply pushing one pin across another." But as this description is somewhat vague, it is well to enlarge a little on the simple, but yet to many amusing and interesting, game of Push Pin.

The game is usually played by two players only, and each player puts down on the table one, two, three, or more pins, as may be decided upon. At starting the pins are to be placed in couples, head to head, one pin of each couple being placed by each player. Each player then alternately pushes his pin with his finger-nail, endeavouring to push it across his opponent's pin, and should he succeed both pins become his, but if he fail his opponent plays. The push is not to be a continued push, but a sort of a shove with the finger-nail, by bending it on the table and letting it fly up to hit the pin in the required direction.

PUZZLE-WIT.

See "Magic Fan."

QUINTAIN.

The Quintain is another balancing toy, very ingenious in construction, which, although it may be made at home, will be found somewhat difficult of construction. One of the leading toy-makers thus describes its manufacture:—"Carve the bust

of a man with a ferocious face; on the face gum a Turkish beard and moustaches; let one arm be extended, half bent, holding a wooden scimitar, and the other bear a shield, adorned with an opening, crescent-shaped, in which hangs a little bell. Load the base of the figure with lead, and poise it on a pin, on which it shall so freely revolve as to move at a touch, even so slight as that of a feather. Now, whoever, trying to make the bell ring with his finger, does not thrust at it very quickly, the figure, turning round, will deal him a smart blow on the forefinger knuckle with the sabre."

QUINTAIN.

The principle on which the Revolving Ring or the Revolving Image works is precisely similar to that of the Quintain.

QUIZ.

See "Bandilor."

RACE GAME.

The Race Game is an interesting round parlour game, which may be indulged in by any number of players up to twelve. It has seen many imitations and modifications of it brought into use, and the games of the University Boat Race and the National Volunteers may be instanced as two specimens of more than ordinary interest; the first of these, however, can only be played by two persons at a time.

The Race Game proper is played on a board, and is subject to rules supplied with the board and the other materials for the game. The board is marked into divisions, and at certain distances obstacles, such as fences, hurdles, and ditches are placed, for the horses participating in the race to clear. The players having

determined the order of playing, each one selects his horse, and places it at the starting-point. Dice and dice-box, or a numbered teetotum, are used, to denote the number of divisions the player's horse is entitled to pass over, but should that number land the horse in any one of the brooks or ditches, or upon the fences or hurdles, the throw of the dice, or, as the case may be, the spin of the teetotum, does not count, and the horse waits for another chance of a move when his player's turn next comes round. Each player alternately takes his chance of moving. The rules by which the game is governed vary considerably, and may be modified in any way agreeable to all the players. The following are given merely as specimen rules, as they are the substance of those most frequently supplied with the game :—

RACE GAME.

1.—When the stakes are agreed upon and the pool made, each member must select his horse, and then enter him at the starting-point.

2.—Each member throws, or spins, for choice of move; the highest number claims the first move, and the others according to the number thrown.

3.—The horse that reaches the winning-post first gains the pool, the second horse saving his stakes.

4.—Steeple or hurdle races can be played by placing fences and hurdles along the course, and any player throwing a number that would place his horse so that he does not clear the fence forfeits his throw, and waits his next turn.

Although the game is made more interesting when played with the materials supplied at the toy-shops, these are by no means indispensable. Any ordinary board, or school slate, may be marked into the necessary course and divisions over which the horses are to travel; a few horses may be readily cut out of some stiff cardboard, and a common teetotum will furnish all the materials absolutely needed for the game. It will be found that the game, so arranged for, will well repay any little trouble taken in manufacturing and obtaining the necessary horses and race-course.

RACQUETS (DRAWING-ROOM).

The game of Drawing-room Racquets is an adaptation of the old-fashioned play of Cup and Ball, as far as is possible, to the game of Racquets played within doors, and in a more or less limited space. The game is usually played by three persons, but the number is immaterial, and may be increased according to the size of the room in which it is played. The game consists in throwing the ball or balls from one cup held by one player to some other cup held by some other player. It is best that the balls should be passed round to the different players in order.

REVOLVING RING.

A ring or a small figure may be so constructed and arranged as to be easily balanced on the top of one of the fingers. Take a piece of wood and cut it into the form of a ring, or get a small wooden ring that is perfectly round; fasten to it two ear-shaped pieces of wood about double the length of the diameter of the ring; balance the ring when so furnished on the point of a pin, and then, if the

balancing has been properly arranged, upon the head of the pin being placed upon the tip of the forefinger the ring may be made to revolve quickly, and at the same time retain its balance, by blowing, at first gently, and then with more force, upon the oar-shaped appendages attached to the ring.

A small figure may be worked in the same manner by cutting a piece of wood to a point, and carving the opposite end into the form of the head and shoulders of a man; the pair of oars should be attached in the place of arms, and then, if care to make the point of the wood exactly in its centre has been taken, the figure will stand upright on the tip of the finger, and by blowing he may be made to revolve in a most amusing manner. The Revolving Figure is a more amusing toy than the Revolving Ring; but in that it requires so much more nicety and delicacy of handling to get the proper balance, it is not so easily made.

There is a capital game known by the name of "Revolving Ring," adapted for either out-door or in-door games. It is played with variously coloured balls, which are thrown at rings similarly coloured. The rings are fitted to a board, and in such a way that with the slightest touch on the rims they revolve. The object of the game is to throw the six balls through the revolving rings, the players taking their stand from the board at some specified distance. Each successful throw counts three; and when a ball is thrown through the ring of the same colour the player scores six.

BINGOLETTE.

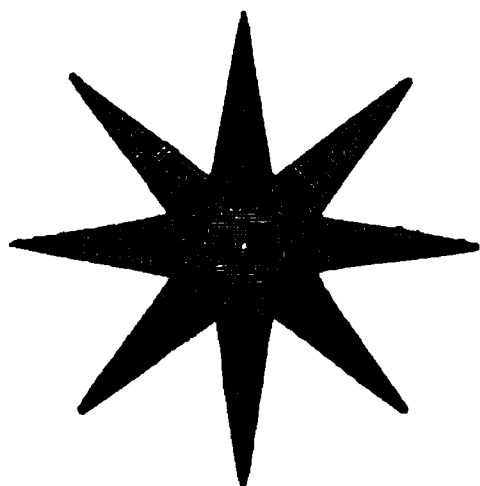
See "Parlour Quoits."

RING THE BULL.

This is a game very similar to but somewhat more simple than that of Parlour Quoits. It also is a game of skill. It is played upon a wooden block, in which are inserted a number of long iron pins, on which the player has to throw rings provided for that purpose. The players score according to the number of rings that are so thrown as to encircle a pin.

ROYAL STAR.

The materials for this game are a large star with eight long rays, each one of which is painted some different colour; and eight wooden balls painted to correspond with the colours of the rays of the star. The rays of the star are not fixtures, but their bases are merely slipped into grooves in the body of the star, so that they can be easily knocked out with the balls.



ROYAL STAR.

To play the game, each player, alternately takes all the eight balls, and standing away from the star at a certain specified distance throws the balls at the star, endeavouring by that means to knock out the rays. If a player should succeed in striking out a ray of the same colour as the ball, two points are scored, but if the ball and the ray knocked out are not of the same colour, one point only is scored. If in any throw the star is altogether missed, three points are to be deducted. When the first player has thrown the eight balls, such rays as may have been knocked out are replaced, and the next player takes the balls and commences the game, and so on until all have had a chance. It is well that a curtain or screen should be arranged behind the star to stop the balls.

SCHIMMEL.

The game of Schimmel, or, as it is generally known, of Bell and Hammer, is a most amusing round game of German origin. The materials for playing the game are comparatively inexpensive, and as some of them can be prepared by any ordinarily clever lad—and all lads are clever—there is no reason why this game should not, were it but better known, attain much more popularity than it seems to be favoured with.

The materials required are—

1.—Five small cards, on each of which are drawn or painted one of the following figures : On one card a white horse, on another an inn, on the third a bell, on the fourth a hammer, on the fifth a bell and a hammer.

2.—Eight wood, bone, or ivory cubes of the size of dice, marked on one side only, six of which are numbered respectively with the numerals 1, 2, 3, 4, 5, and 6 ; the other two cubes being marked, the one with a bell, and the other with a hammer.

3.—A dice box with which to throw the cubes.

4.—A hammer for knocking down the cards to their respective purchasers, which are disposed of by auction, as set forth hereafter.

5.—A bag of counters.

The game may be played by an unlimited number of players, the more the better, it being especially advisable that at least seven should join in the game. The mode of procedure is as follows :—One of the players is to be selected as cashier, and to him has to be entrusted the bag of counters. A considerable number of these should be equally divided among all the players, and if it is desired they may be taken to represent value. Nuts make good substitutes for counters, as to those players not yet troubled with indigestion they possess in themselves a certain value, especially if it be understood that all winnings may be retained (or eaten).

A pool has to be formed, into which each player pays twelve counters. It is then the duty of the cashier to sell by auction to the highest bidders the five cards, the produce of which also is paid into the pool. Each player is at liberty to purchase as many of the cards as he may be inclined, and,

THE MATERIALS FOR SCHIMMEL.

moreover, he is not bound to pay for all, but is at liberty to take credit for a certain portion of his purchases if they exceed the number of counters originally dealt out to him ; only payment of the debt so incurred must be considered as a first charge on subsequent winnings. The cards will, by experience at the game, be found to be of various values ; but the number of counters to be paid for each is determined by the speculative natures of the players, and it, indeed, often happens that those players who invest in no cards at all are at the end of the game the richest in the matter of wealth as reckoned by counters. The respective values of the cards are as follows :—The white horse ranks first, and immediately

after him comes the inn, the cards representing respectively the bell and the hammer are of about equal value, and come next, while that representing both the bell and the hammer is lowest in the scale, and is worth just half that at which either of the two cards on which are painted the single figures is valued.

The cubes are then to be thrown by the players alternately, their order having been previously arranged, it being always allowed, however, that the possessors of cards take precedence over the other players, and over each other, according to the relative values of their cards. It should be stated rather that each player alternately is entitled to a throw of the cubes or dice, for any player is at liberty to sell his throw to any other player inclined to speculate therein. When the cubes are thrown and show uppermost all blanks, all the players have to pay one counter each to the holder of the white horse, and he again pays one to the holder of the inn. If the cubes turn up with the bell or the hammer, or with the bell and the hammer, the holder or holders of these cards pay one counter to the white horse. When the bell, hammer, or bell and hammer are thrown accompanied with numbers, the amount of the numbers thrown has to be paid in counters to the holder or holders of the cards out of the pool; if numbers are thrown unaccompanied with either bell or hammer, or bell and hammer, the thrower of the cubes receives from pool the number of counters indicated by the cubes.

It is when the pool is becoming exhausted that advantages accrue to the holder of the inn, and this indeed is usually found to be a very speculative holding. If any player in his throw shows numbers combined greater than the number of counters remaining in the pool, he receives nothing from pool, but pays to the holder of the inn the difference between the number of counters remaining and the number indicated by the cubes; for example, if five counters are remaining in pool, and seven are shown uppermost on the thrown cubes, the player who threw the cubes pays two counters to the holder of the inn, and leaves the five counters in the pool. So on the play proceeds, until some figure is thrown which, clearing the pool, concludes the game.

After the holder of the inn card begins to receive payment, should all blanks be thrown, the players throwing the cubes pay nothing; but instead, the holder of the white horse pays one counter to the holder of the inn; should the bell or hammer, or bell and hammer be thrown with the blanks, the holder or holders of the card or cards indicated each pays one to the holder of the inn. If numbers are thrown accompanying the bell, &c., the holder of that card pays to the inn the number thrown in excess of the number of counters remaining in the pool.

SHOVEL BOARD.

The game of Shovel Board was once a very important national pastime, and was much played among fashionable people. Master Slender, in "The Merry Wives of Windsor," makes a reference to the game, from which it would appear that Shovel Board was in Shakspeare's time both popular and fashionable.

The game was formerly played upon a long, low table that usually stood in the large hall of a gentleman's house, but was soon adapted to smaller tables, and was indeed frequently played on the floor, the necessary limits being chalked out on the bricks. The following description of the game will be found applicable, whether it be played on the floor or on the orthodox table or board, it being premised that the space marked out on the floor should be about twenty-five or thirty feet in length and three feet in breadth, a space corresponding with the size of an ancient Shovel Board.

The tables on which the game is now played vary somewhat in length, but are usually three feet to three and a half feet wide. At one end of the table a line is

drawn parallel with the edge, and three or four inches from it; at four feet distance another line is made over which it is necessary for the weight to pass when shoved or thrown. The players stand at the end of the table, opposite to the two lines above mentioned, each having four flat metal weights, which they alternately shove from them one at a time. The object of the play is to give sufficient impetus to the weight to carry it beyond the mark nearest to the opposite edge of the table, but so as to keep it on the table. If the weight is shoved so that it hangs over the edge without falling, three are counted towards game; if between the line and edge, without hanging over, two are scored; if on the line one only is credited to the player. The game is usually eleven when two play, but when more than two are jointly concerned that number should be increased.



SHOVEL BOARD.

Those weights that glance off the side of the table, that do not pass the first line, or that fall off the table at the opposite edge, it will be seen do not score. It is sometimes allowed that all weights passing the first, or four-foot line, score one, instead of making it incumbent that the second line should be reached.

The following description of the game, which differs somewhat from the above, appears in the "English Cyclopædia":—"The origin of the game Shuffle, or Shovel Board, is doubtful; it has been practised for many generations . . . and has lately been largely introduced into America. . . . The board, or alley, is thirty feet long by twenty inches wide, perfectly level, like a billiard table, and constructed of some wood which will not warp. Before commencing to play, it is sprinkled with fine sand, and five inches from each end a line is drawn across the board, parallel with the ends. Eight weights or pieces are required, divided into two sets of four each, and marked with distinctive features. The game is played by four people, two against two, one on either side standing at each end of the board. Twenty-one points have to be scored to win a game; each piece which lies over or inside the line, at the end of a round being 'in,' and scoring two points in favour of the side to which it belongs, whilst a piece partly projecting over the end of the board scores three points. Should no piece be 'in' at the end of a round, that nearest the line counts as one point, and a piece lying exactly on the line is counted 'in.' The players 'shuffle' alternately from each end of the board, the great object of each competitor being to 'shuffle' his own piece in, or drive his opponent's off the board."

SKITTLE CANNONADE.

The game of Skittle Cannonade, or Indian Skittle Pool, is a capital game for boys. It is in its higher development played on an ordinary billiard-table, but a bagatelle board will answer all the purpose, or it may even be played on a common dining-table, provided that round its edges are placed such cushions as are supplied with a Table Croquet set.



Two white balls, one red, and one blue ball are used in the game, and five small skittles are placed in the centre of the board or table. The skittles are of different values, and are numbered as follows (as shown in the accompanying plan). The first opposite to the baulk is one, that to the right two, that opposite to the first, three, the one opposite to the second, four, and the centre skittle, five. The points are made by knocking down the skittles, as shown hereafter, each skittle knocked down counting points according to its number. In commencing to play, the red ball is placed as in the

ordinary cannon game of billiards, the blue one beneath it, and the two white balls are retained for the two players who play first. The white balls should be played with alternately by the players, and no score is made except from a cannon, that is, the ball struck with the cue must hit some other ball before the skittle is knocked down; but it does not then matter by which ball the skittle or skittles are knocked down. The first player is bound to strike the red ball, and the second player the blue ball, but afterwards either ball may be struck at. A ball being knocked off the table, or into a pocket when a billiard-table is used, destroys all the points made by the stroke, and if the ball knocked off is either the red or blue ball it must be again placed as in starting the game. The skittles are replaced after every stroke, if necessary. Thirty-one points, neither more nor less, win the game; any one scoring beyond that number is dead and out of the game; or the survivor from amongst all the players wins the game if no one player scores the exact thirty-one required. Any player knocking down the four outside skittles, leaving only the centre one standing, wins the game, having made what is technically called "the royal." After each win a new game is started.

The player who first reaches either twenty-nine or thirty points has the right to stop scoring on his declaring to do so, and any point which he may subsequently make counts to the advantage or disadvantage, as the case may be, of the previous player. This right to stop scoring can only be exercised by one player in each game, and if he who first reaches the required number of points refuses to exercise that right, it passes to the next who attains the required number, and so on.

There is also another version of the game of Skittle Cannonade played on a board specially prepared, and the result of which depends entirely upon chance. A teetotum, as in the game of Cannonade, is used instead of balls and a cue, or sometimes a top is made to do duty for the teetotum. Nine specially-made skittles are used, each of which is placed on a spot inscribed with a number. When the skittles are placed, the top or teetotum is smartly spun at one corner of the board by each player alternately, and the scores are made according to the numbers which are laid bare by the skittles being knocked off them. The great point in the game is to give the top or teetotum a smart jerk when spinning it, so as to make it retain its power of movement as long as possible. This description of the game is far inferior to the version described above, but the whole of the materials form a pretty toy, and much amusement for the youngsters is to be obtained from the game.

SLATE GAMES.

There are a few simple slate games which have been in the past, and no doubt will be in the future, the means of affording innocent amusement to many a youngster. They are none of them very elaborate, are usually intended for only two players, and are best grouped together under the one general heading of Slate Games. The first to be described is the game known as

Birds, Beasts, and Fishes.—Two boys take their slates, and each one writes down the first and last letters of the name of some bird, beast, or fish, first stating from which category the name is selected, and puts a cross for each of the intermediate letters. For example, A elects to write down the name of a beast, and marks on his slate as follows—Hxxxe; B will perhaps select a fish, and mark on his slate Gxxxxxn; they then exchange slates, and each tries to guess the name of the beast or fish indicated, and fills up the blanks accordingly. It is evident that those indicated above are respectively Horse and Gudgeon.

French and English.—A slate should be divided into three divisions, the top and bottom divisions each having a small compartment marked off therein, as shown in the annexed diagram. One of the two end divisions should be allotted to the

English and the other to the French, and marks put therein to represent the soldiers of the respective nations. Each player having provided himself with a well-sharpened pencil, the game is played as follows:—The players decide the order of play, and he first selected, being supposed to be English, places the point of his pencil at the spot marked in the smaller compartment of the English division of the slate, draws it quickly across the slate in the direction of the opposing army. The pencil will, of course, leave a line marking its track, and all the men of the opposite side, through which the track passes, count as dead. Each player plays alternately, and he wins who first kills all the men on the opposite side. The track of the pencil must be rapidly made, and must be either straight or curved; any track in which there is an angle does not count. Sometimes the players turn their heads or close their eyes when making the track.

Noughts and Crosses, or Tit-Tat-To.—This game, when played out of school-hours, should be wound up with the following rhyme by him who wins the game:—

Tit-Tat-To, my last go;
Three jolly butchers, all of a row.

“When played out of school?” some readers will say. Yes; this qualification is necessary, for it is to be feared and deprecated that this game, as well as that of “Birds, Beasts, and Fishes,” is frequently played in school-hours, to while away the weary time that ought to be devoted to the solution of arithmetical or algebraical problems. These slate games are undoubtedly little boys’ games, but many are the big boys who indulge in them surreptitiously, if not openly.

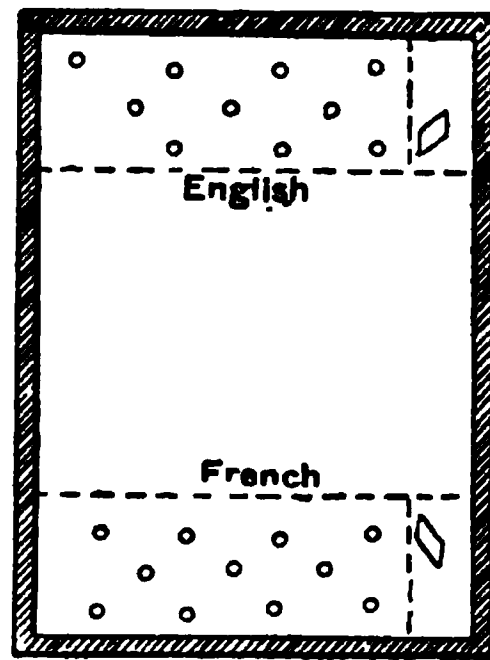
X	O	X
O	O	X
X	X	O

NOUGHTS AND CROSSES.

The game of Tit-Tat-To is played on a figure, similar to the annexed, made on an ordinary slate. The players alternately mark in the figure—the one a cross, and the other a nought; he who first obtains a row either horizontally, perpendicularly, or diagonally wins the game, and calls “the three jolly butchers, all of a row.” The object of each of the players is equally to obtain such a row, and to prevent his opponent from obtaining one.

SPILLIKINS OR SPELICANS.

The game of Spelicans is similar to that of “Jerk-Straws.” The spelicans are a number of thin pieces of ivory or bone, cut into odd and various shapes—some like saws, some like spears, some like hooks, &c. Each spelican is inscribed with a number, the lowest being 5 and the highest 40. The spelicans are taken up in the hand of any one of the players, except by him who plays first, and dropped upon the table in a heap; the other player or players, as the case may be, then alternately endeavour to remove a spelican from the heap either with the fingers, or by the aid of two small hooks provided for the purpose, without in the slightest degree disturbing any other spelican. At the end of the game each player adds up the numbers marked on the spelicans he has captured, and he who can show the highest number wins. Sometimes, instead of each player alternately trying to remove one spelican, it is allowed for one player to continue removing spelicans one by one until



FRENCH AND ENGLISH.

more than one pelican is disturbed in the same try, when the play passes as before.

SQUAILS.

In some places the game of Squails bears the name of Trails. It is an amusing round game, which can be played on any ordinary table by two or more players of an even number—not, however, exceeding eight. Each player is furnished with an equal number of coloured wooden pieces or discs, which are called squails, and these the player has to place at the edge of the table, half over the edge, and strike them with the open palm of the hand towards a small medal placed in the centre.

The players should be divided into sides, and one from each side should alternately strike a squail towards the medal. A circle should be drawn round the medal, and should

SQUAILS.

the medal be knocked out of the circle during the play, it must be replaced. The object of the game is to secure for one's own side the largest number of squails near to the central medal, and to obtain that it is legitimate not only to shove one's own squail towards the centre, but also to knock an opponent's squail away or a partner's squail near to the medal.

The game of Squails, for a year or two after its introduction, seemed in a fair way to rank among the most popular round table games, but it soon died out and is now but little played. It deserves, however, much more notice than it usually receives, and we would recommend it as a great improvement on most of the elaborate toy games that are patronised so extensively. A set of squails costs but a trifling sum.

SQUEAKER.

The Squeaker is an instrument with which it is generally supposed that the peculiar squeak of Punch, in the Punch and Judy show, is produced. To make it, get two little pieces of tin, each about an inch long, and half an inch broad, and bend them slightly inwards.

Now wind a piece of tape round the pieces of tin when placed together, and fasten the whole together with thread. Blow through the instrument, and by the vibration of the central piece of tape a peculiar squeaking sound will be produced.



STEADY TAR.

Another very simple squeaker is made by placing the two thumbs together alongside of each other, and laying as tightly as possible in the hollow between the thumbs a blade of common grass. If the piece of grass is then blown upon, the same horrible squeaking noise will be produced.

STEADY TAR.

The Steady Tar is another toy of the balancing order, several of which have already been described. To make this toy, stick a needle into a cork, and place the cork, needle upwards, tightly into a bottle. Carve the figure of a sailor—any other figure will answer equally well—out of light wood, cork, or pith, and mount him on a hard wood ball. (See figure in the illustration.) Through the centre of this ball run a wire, which must be bent, as in the woodcut, into a half circle, to each end of which a small leaden weight or bullet of equal weight must be attached. If the hard wood ball is then placed on the needle sticking out of the cork in the bottle, the figure may be spun round, and tipped in any direction; if properly made it will always recover its erect and steady position.

SUMMER ICE.*

This is a first-rate in-door game, founded on the celebrated Scottish game of Curling. The materials for the game are made and supplied by some of the toy manufacturers; but the game, which, although founded on

SUMMER ICE.

Curling, has also some resemblance to Shovel Board, may be played on any ordinary table with a plain surface. The materials as supplied consist of a long mahogany folding board, at one end of which is a circle, and sixteen flat weights. It is the object of the players to hurl the weights along the board to reach the circle at the other end. After the players have delivered their weights, that side which has the greater number of stones lying nearest to the tee or mark counts one for each weight so lying. Thus, if side A has two weights nearer than any belonging to side B, the former would count two to their score.

SYBIL.

See "Prophet."

TABLE CROQUET.

See "Parlour Croquet."

TARGETTA.

TARGETTA.

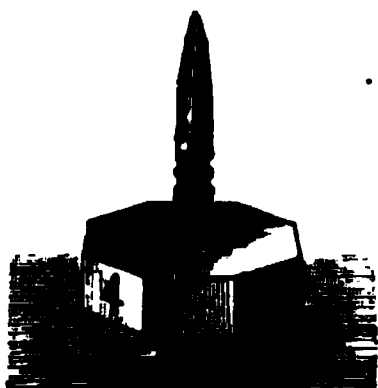
The game of Targetta is a drawing-room game, which is played on a target somewhat resembling a pedestal fire-screen, and similar to the illustration annexed. In the oval central part of the target are fixed a number of pins which are retained in their places by

* This game has been registered by Mr. Cremer, of 210, Regent Street, as has also the following one called "Targetta."

means of springs that are dislodged immediately upon the pins being struck. The pins are thrown at by a ball attached by a long string or cord to the top of the target, and scores are made according to the number of the pins dislodged.

TEETOTUM.

The Teetotum is a kind of top or whirligig that is spun round by twisting the upper part between the thumb and finger. It is usually of a hexagon or octagon shape, but sometimes it is four-sided only, and may be easily made by cutting a piece of wood of an inch or thereabouts in diameter, and a third of an inch in thickness, into the required shape. A stick run through the middle of the disc and fixed makes it complete, and the result is a useful rough and homely teetotum.



TEETOTUM.

Originally teetotums had four sides only, which were respectively marked with the letters T, H, N, and P, signifying Take all, Take half, Nothing, and Put in again to pool. The toys, as now improved, are made with more sides, and are variously numbered. In many of the toy games a teetotum is used in place of dice, but simple teetotum games are played with nuts or some such things

for stakes. There are otherwise no special games for the teetotum; it is mostly used in various race and other games of chance.

TIT-TAT-TO.

See "Slate Games."

TOURNAMENT.

This is another new round game, a development of and improvement upon some old friends. It is played on a circular mahogany board. A number of tops, teetotums, or champions of different colours are spun in the centre of the board by different players, and these tops are apt to strike and knock each other about. The player whose top dies nearest the centre of the board wins the game. The game may be played on an ordinary tray, or even on a table if desired.

TRAILS.

See "Squails."

TROUBLE-WIT.

See "Magic Fan."

WONDERFUL TRUMPET.

The wonderful trumpet is a very simple toy, and to those who like practical joking, affords amusement, except to the one against whom the joke is made. Get a tube made of tin, wood, or cardboard, a piece of cork, and the hollow part of a quill. Cut a slice about half an inch in thickness off the cork, and place it about half-way down the tube, as at *a b* in Fig. 1 in the illustration. Next cut a second slice from the cork, making notches round its edge, and a hole in the centre through which to pass the quill. When this is done fix it at the points *c d*, contriving so that the quill will extend about two-thirds of the way down the upper compartment of the tube. Instead of closing up the compartment *e* with a piece of cork at the point *c d*, wood, tin, or cardboard may be used, it only being necessary that a number of small notches or holes should

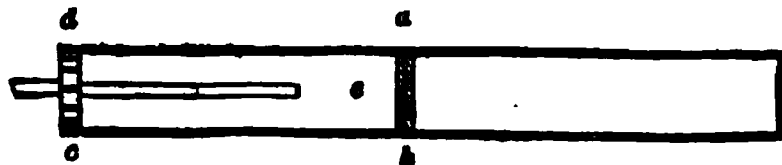


Fig. 1.—SECTION OF WONDERFUL TRUMPET.

be cut in the material used. The trumpet is then complete, and should be represented by Fig. 2.

The following is the use to which it is put:—Place flour, or some harmless dust or powder, in the compartment of the tube marked *e*, block up as instructed the end at *c d*, hand the trumpet to him against whom the joke is to be directed, and instruct him that by blowing through the end of the quill protruding an effect both marvellous and unexpected will be produced. “Blow hard,”

say; “the harder the better.” If he carries out his instructions the flour or powder will come through the holes or notches at the point *c d*, covering the face of the poor unfortunate victim. Viciousness



Fig. 2.—WONDERFUL TRUMPET.

in the use of this instrument should be sternly condemned—a little flour in a boy's face will not harm him, but great care should be taken to ascertain the effects of the material placed in the tube, as certain powders lodging in a person's eyes might do serious injury. Practical joking is not to be much encouraged, but, practised occasionally, and with fun only for its object, is not to be entirely condemned.

In winding up the section on Toy Games and Toy-making, it is appropriate to quote the remarks of some of the jurors of the Great International Exhibition, held in London in 1862, who said in effect, when speaking of toys generally, in setting forth their views on the subject, “that toys should be vivid, innocent, and delightful; fitted to teach children to open their eyes, to compare and to observe, and to make them aware how rich and varied are the phenomena of the fair world into which they have been placed, and how much happiness is to be obtained in it.”

The manufacture of children's toys forms a very considerable item in the leading industries of the world. The United Kingdom of Great Britain and Ireland alone imports foreign toys to the amount of upwards of £600,000 annually, and this is entirely in addition to the considerable support given to an extensive home manufacture. Among the miscellaneous toys referred to at the commencement of this section were “Noah's Arks,” and much wonder has frequently been expressed at the small sum for which toys of this nature are to be purchased. They are usually the product of the skill of Germans and Tyrolese. In the Valley of Grödnertal, in Tyrol, where almost every cottage is a carver's workshop, Noah's Ark animals are made in very large quantities from a species of pine. The wood is cut into slabs, of from fifteen inches in diameter by three inches thick, the grain of the wood being in the direction of the thickness. A circular piece, six inches in diameter, is cut out of the centre, leaving a ring four or five inches broad. This ring is turned in a lathe, with chisels and gouges, over every part of the surface, on both sides, and on the inner and outer edges. The curvatures, ridges, &c., are very remarkable, but are perfectly understood by the workmen, and by them only. The outer ridge is then cut up radially into slices, each of which slices presents the outline of some animal on both surfaces, the shaping of the wood in the lathe having been such as to bring about this result. Each separate piece is ultimately brought to completion by hand-carving. One of the museums in Kew Gardens, near London, contains specimens of this singularly ingenious manufacture, in various stages of progress.

MECHANICAL PUZZLES.

It would be impossible to give a complete list of the subjects that might be fairly classed under Mechanical Puzzles. What is a puzzle to one generation is none to the next, and so on; new puzzles are constantly being invented and found out. There are a few old ones around which a considerable amount of interest must centre because of their intrinsic merit, and which should find a place in every book prepared for the amusement and recreation of youth; there are also new ones not yet much known, which should be mentioned more because of their newness, perhaps, than their merit.

BALANCING PUZZLES.

A few Balancing Puzzles have been included in the section allotted to Toy Games and Toy-making, for inasmuch as a certain amount of making was necessary, it seemed proper to place them there, and it is sufficient now to refer the reader to that section for some varieties in Balancing Puzzles that are not to be found here.

The Balanced Pail (Fig. 1).—To balance a pail suspended by its handle on a stick, less than half of which rests on its support, would seem to be an impossible feat.

It is to be done, however, if the following instructions be carefully followed:—Take a stick (C D), over which the handle of the bucket or pail is to be placed, and place the stick about two-fifths of its length on a table (A B). The handle of the pail should be so placed over the stick as to be in an inclined position shown by the letters H I, and so that the edge of the pail may touch the edge of the leg or side of the table. To make the pail retain

Fig. 1.—THE BALANCED PAIL.

its position, another stick (E F G) will be required, the one end of which should reach to the bottom of the pail, the other end being fitted into a notch previously cut at the point E, in the first stick (C D). The stick (E F G) should rest on the edge of the pail at the point F. The bucket will thus be kept safely balanced, and may, provided the sticks are fairly strong, without risk be filled with water.

The Balanced Stick.—A stick may be balanced and made to stand upright on the top of the finger by first taking the precaution to insert into its upper end, at about half an inch from that end, two knives, or two forks, or two other articles of equal weight. The stick should be of such a length that the ends of the knives are a trifle lower than the end of the stick when balanced.

A similar puzzle is to make a coin turn on its edge on the point of a needle, or to make a needle turn on its point on the head of a pin. For either of these puzzles, get a bottle, cork it tightly, and in the cork (which we will name B) place a needle or a pin; then take another cork (which we will call X) and cut a slit in one of its ends, so that the coin to be balanced will fit into the slit. If it is on a needle that the coin has to be balanced, force the needle into the cork B point outwards. Now stick two common steel forks, one on either side, into cork X, so that the forks hang downwards; place the coin in the slit of the last-mentioned cork and the edge of the coin on the point of the needle. If the needle is to be balanced on a pin, place the needle in the same manner; the weight of the forks will keep the toy balanced, and enable it to be safely spun round without danger of falling.

The Bridge of Knives (Fig. 2).—Three knives may be supported by their handles on the rims of three cups or glasses in the following manner:—Place the glasses in a triangle, each side of which shall be about equal in length to one of the knives to be balanced. The blade of the first knife should rest on the blade of the second by passing over it near to the point where the handle and blade are joined, the blade of the second passing in the same manner over the blade of the third, which is to be made to rest on the blade of the first. The handles being then properly placed on each one of the glasses forming the triangle, the bridge will be made, and it will be strong enough to bear a considerable weight.

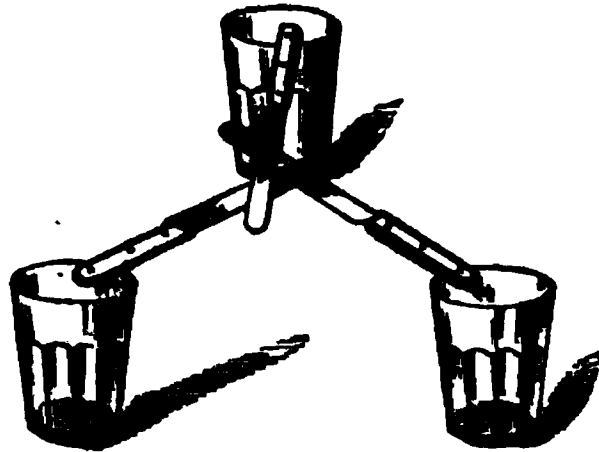
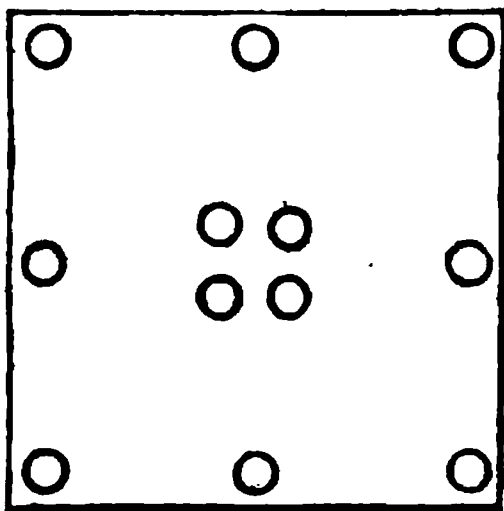


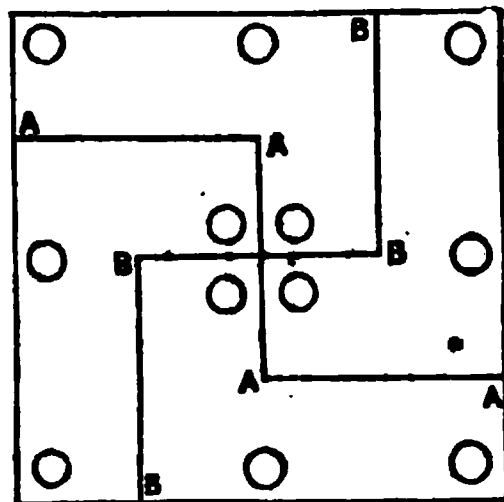
Fig. 2.—THE BRIDGE OF KNIVES.

THE SQUARE AND CIRCLE PUZZLE.

Cut a square piece of cardboard, marked as shown in Fig. 3, into four pieces

Fig. 3.—SQUARE AND CIRCLE
—THE PROBLEM.

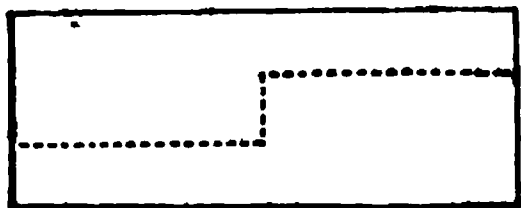
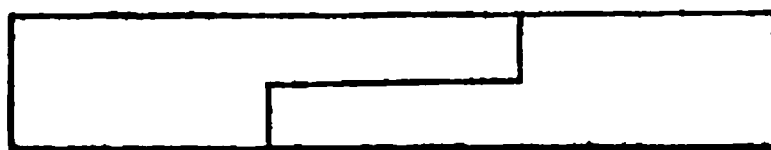
of equal size and similar shape, so that each piece shall contain three of the marks, and so that none of the marks are cut. Fig. 4 shows that the puzzle is solved by cutting the lines A from a quarter down on the left-hand side to half-way across, then down through the middle to three-quarters of the distance from the top, and then along to the opposite side of the card. The line

Fig. 4.—SQUARE AND CIRCLE
—THE SOLUTION.

B takes a corresponding course, being commenced on the top line at a quarter of the whole distance from the right-hand side.

THE CARPENTER'S PUZZLE.

This is very similar to the above. A carpenter had to mend a hole in a floor which was two feet wide and twelve feet long. The board given him to mend it with was three feet wide and eight feet long. He was instructed to entirely

Fig. 5.—CARPENTER'S PUZZLE—
THE PROBLEM.Fig. 6.—CARPENTER'S PUZZLE—
THE SOLUTION.

cover the hole, to allow no part of the board to overlap, and he was allowed to cut the board into two pieces only. He accomplished the feat by cutting the board as shown by the dotted lines in the annexed Fig. 5, and joining them over the hole in the floor in the manner shown in Fig. 6.

THE DIVIDED FARM.

This is a still more complicated puzzle of the same description. It is the last of the sort we shall give, but many more of a like character may be constructed.

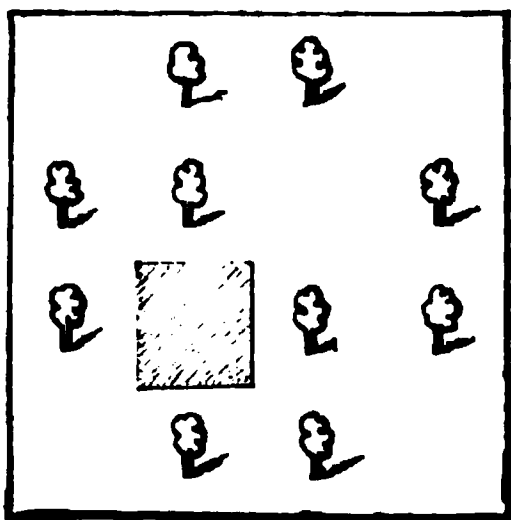


Fig. 7.—THE UNDIVIDED FARM.

A Frenchman died leaving five sons, among whom he had expressed a wish to divide his farm, on which ten trees grew, so that they all might live together in the house (represented by the dark square in the diagrams), and so that each might have an equal share of land, of a similar shape, each share having two trees growing upon it.

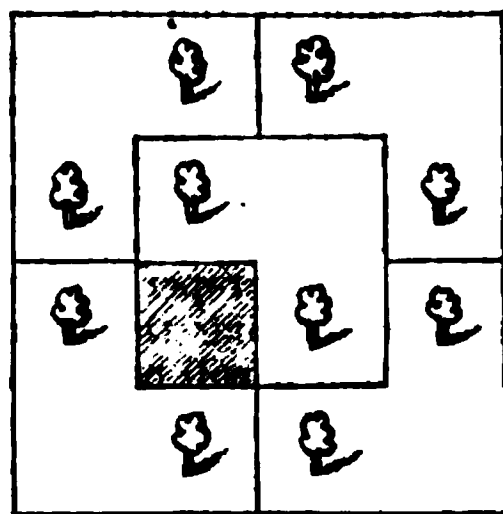


Fig. 8.—THE DIVIDED FARM.

Fig. 7 shows the land before it was divided; the lines in Fig. 8 show how the fences were put up when the old man's wish had been carried out.

THE VERTICAL LINE PUZZLE.



Fig. 9.—THE VERTICAL LINE PUZZLE.

This puzzle is very old; but, although simple, is very good. It may be treated either as a mechanical or as an arithmetical puzzle. Place six narrow strips of cardboard of equal length in a row, and add five other pieces in such a way that the whole form nine only. The result is shown in the second row of lines, the added pieces being represented by the dotted lines (Fig. 9). This puzzle may be said to be only a play upon words, but in most puzzles there is some catch.

THE STRING AND BALLS PUZZLE.

Get a thin piece of wood, bone, or ivory, of the shape shown in the annexed figure (Fig. 10); bore in it three holes—one at each end, and one in the middle. Pass a piece of string or twine through the middle hole, leaving a loop, as shown; on each side of the string thread a ball or ring, and fasten the two ends of the string with knots at the holes at the end of the piece of wood. The puzzle is, without removing the string from the holes or without untying the knots, to get both balls or rings to the same side of the central loop instead of on opposite sides. The following is the solution of the puzzle:—Draw the central loop of the string well down, and slip through it either one or other of the balls until it reaches the back of the central hole; then pull the loop through the hole, and pass the ball through the two loops that will thus be formed; draw the string back through the hole as before, and the ball may easily be passed to that part of the string on which the other ball has been strung. This plan of passing the loop through the central hole is a key to all the puzzles of this nature. Such puzzles appear under various names, but they may all be solved if the key to this puzzle of the Balls and String is borne in mind.

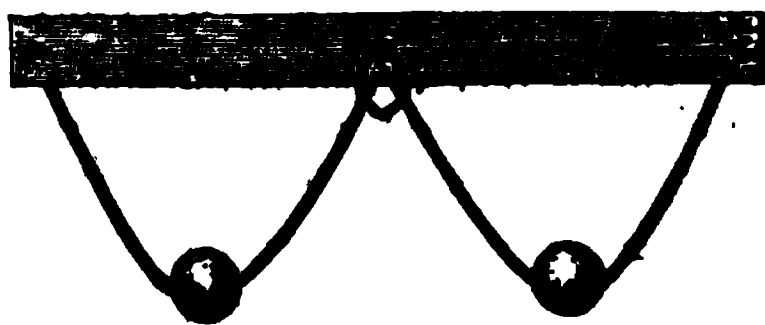


Fig. 10.—STRING AND BALLS PUZZLE.

A somewhat similar, although more complicated puzzle, is that known as

THE PUZZLING RINGS.

This name, by the way, describes the puzzle, but it has been so many times christened, that no list of names could claim to be a complete list. The puzzle is smart and neat, but the parts have to be so nicely fitted, that it would not be easy for an amateur to make it. It may be purchased at a small cost at any toy-shop. The following is its description:—In a flat board of wood, bone, or metal are a certain number of holes—more or less, according to the size of the puzzle. In each hole a wire is loosely fixed, beaten out into a head at one end, to prevent the wire slipping through the hole; and the other end is fastened to a ring, which is also loose. Each wire has been passed through the ring of the next wire previously to its own ring being fastened on; and through the whole of the rings runs a wire hoop or bow, which also contains, within its oblong space, all the wires to which the rings are fastened, the whole presenting so complicated an appearance as to make the releasing the rings from the bow seem to be an impossibility. The puzzle, nevertheless, is to take off the rings.

The following is the plan to be followed:—The instructions given are for removing the rings from a *seven-ring puzzle* (Fig. 11), that being the simplest form, in which the puzzle is made; but it should be noted for general guidance that if an even number of rings are on the bow, the first and second are to be brought down together; if odd, the first one only. To proceed:—Take the hoop in the left hand, and hold the puzzle so that the first ring to be taken off is at the end farthest

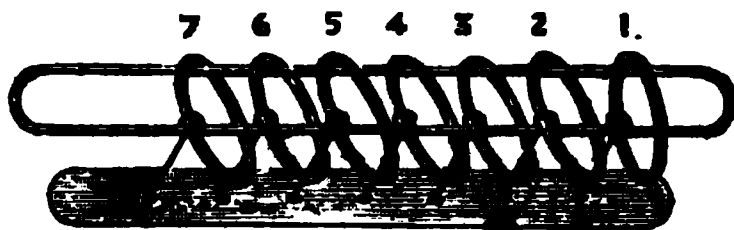


Fig. 11. — THE SEVEN-RING PUZZLE.

away from that hand. Draw down the first ring from the bow, and drop it down through the bow, so that it may be between the board and the bow; proceed similarly with the third ring; replace the first, by passing it up through the bow; bring it (the first) to the end of the bow, bearing in mind that the wires supporting the rings must be perpendicular between the two sides thereof; bring down the rings 1 and 2 together; then bring down No. 5; take up 1 and 2 together; bring down 1; take up 3 and 1; bring down 1 and 2 together; bring down 4; take up 1 and 2; bring down 1 and 3; take up 1; bring down 1 and 2 together; and bring down 7; which completes the seven-ring puzzle.

To put the rings on again:—Put on 1 and 2; bring down 1; take up 3; and then 1; bring down 1; and so on, always taking up the first or outward rings.

The seven-ring puzzle is, as already stated, the simplest of these puzzles, as the ten-ring puzzle is usually the most complicated. To perform the ten-ring puzzle it has been computed requires no less than 681 moves. The instructions given above apply equally well to both, if only the note as to an odd or even number of rings to be removed is remembered.

The puzzle of the *Balls and Rings* (Fig. 12) has points of similarity with the above, and also with that of the *string and balls* puzzle. The *balls and rings* puzzle is very ingenious, and should be asked for at the toy-shop. It consists of a round frame of mahogany, about two inches in width and a quarter of an inch thick. In this frame, and at regular intervals, are holes, between which are placed, on the one side of

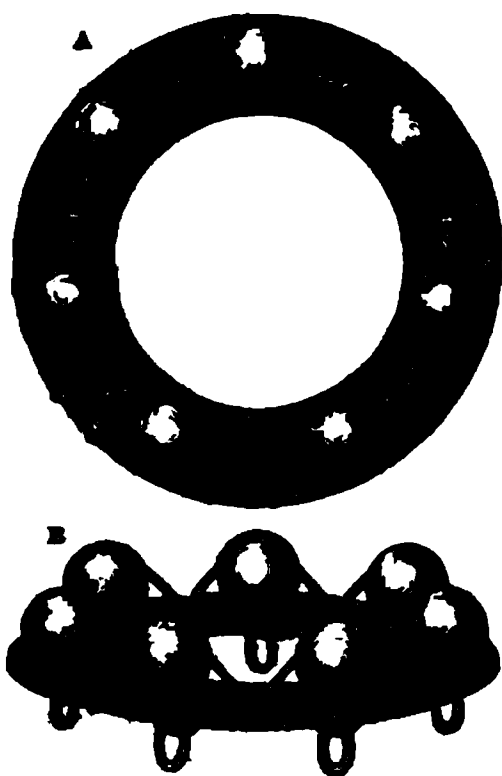


Fig. 12.—BALLS AND RINGS PUZZLE. — A, PLAN; B, SIDE VIEW.

the frame, rings, and on the other side, balls. The rings and balls are made fast with a cord, which passes through each ring and each ball, and also through all the holes in the frame, the ends of the cord being tied in a cross. The puzzle is to reverse the position of both the rings and the balls from one side of the frame to the other.

As indicated in the *String and Balls* puzzle, the key to this and similar puzzles is to be found in a loop of string, which is usually concealed in some part of the puzzle. The loop should be pulled out or through the wood, and passed over the ball nearest to it; the solution of the puzzle will then be apparent.

THE STAFF PUZZLE, THE VICTORIA PUZZLE, AND THE ARTILLERY PUZZLE.

These are all ingenious puzzles of this class, introduced by Mr. Cramer, of Regent Street, who issues the keys for the solution of the puzzles with the toys.

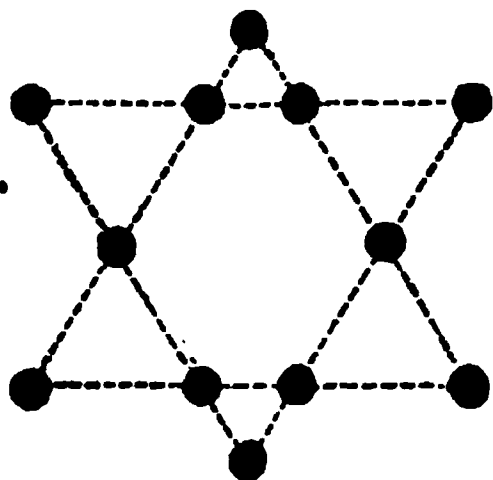


Fig. 13.—THE SIX ROWS PUZZLE.

THE SIX ROWS PUZZLE.

Place twelve counters in six rows in such a manner that there shall be four counters in each row. Fig. 13 shows how the puzzle is solved.

THE SIX SQUARE PUZZLE.

Place twelve counters on a piece of slate or cardboard, so that they would be at the angles of six squares, as shown in M, in the accompanying diagram.

(Fig. 14). The puzzle then is to take away three counters, so that the remaining nine counters shall describe three squares only. The solution is shown in N, Fig. 14. The twelve counters form the six squares A, B, C, D, E, F, whereas upon the counters 1, 2, and 12 being removed the squares C, D, and E only are left.

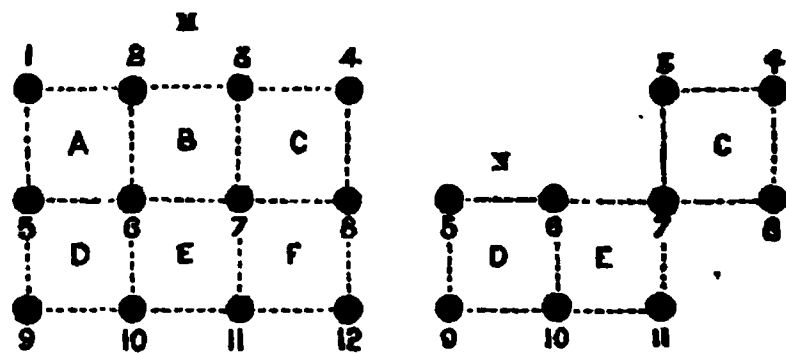


Fig. 14.—THE SIX SQUARE PROBLEM—THE PROBLEM (M) AND THE SOLUTION (N).

THE MAGIC OCTAGON.

Out of a piece of stiff cardboard, cut four of each of the three designs shown in Fig. 15, A, and so join them

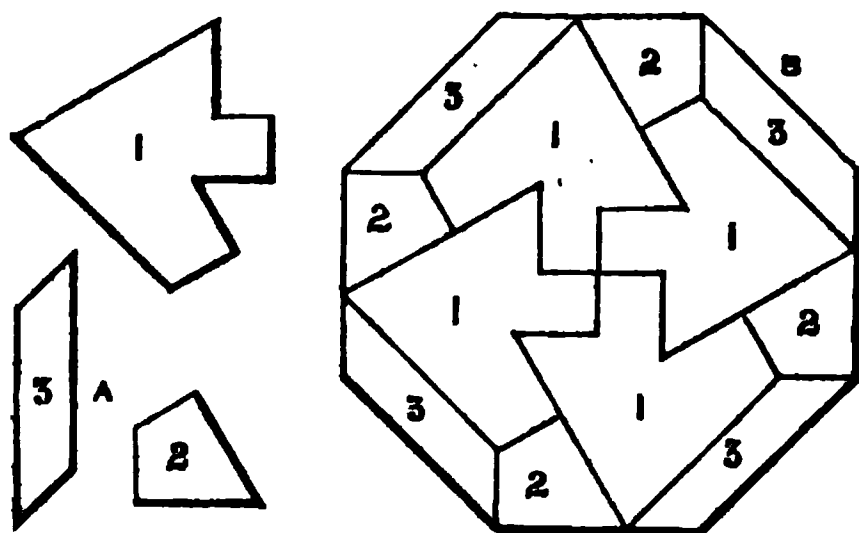


Fig. 15.—THE MAGIC OCTAGON—A, THE PIECES; B, THE OCTAGON.

together that they form an octagon figure. The pieces numbered 1 are to be fitted together in the centre, the pieces 2 and 3 being placed alternately round the pieces numbered 1, after those pieces have been fitted together (Fig. 15, B).

THE ACCOMMODATING SQUARE.

Out out eight squares of cardboard; divide four of them into halves, cutting them from corner to corner, so that there are in all twelve

pieces. The puzzle is to form a square with the twelve pieces. It is to be done as shown in the accompanying plan. The four squares and the eight triangular pieces are numbered respectively 1 to 4 and 5 to 12 (Fig. 16).

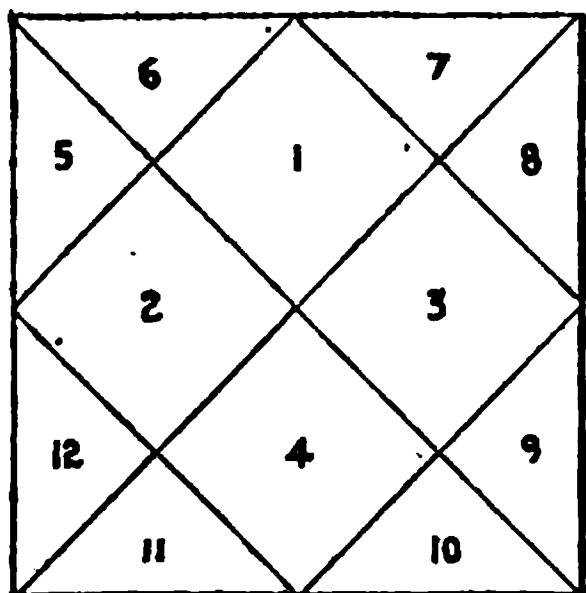


Fig. 16.—THE ACCOMMODATING SQUARE.

THE MAGIC CROSS.

Take three pieces of cardboard of the shape of the figure numbered 1 in Fig. 17, A, and one piece each of the shapes of 2 and 3. The pieces may be of any size, but it is hardly necessary to say that rela-

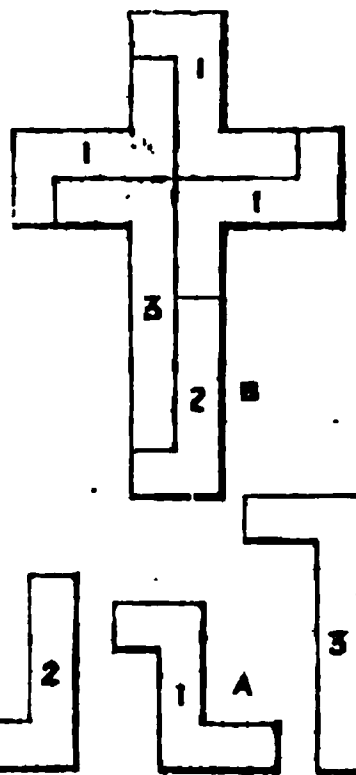


Fig. 17.—A, THE PIECES
B, THE CROSS.

tively each one must correspond with the sizes and shapes indicated in the diagram. Fig. 17, B, shows the pieces when put together and forming the cross.

TO TAKE A MAN'S WAISTCOAT OFF WITHOUT REMOVING HIS COAT.

This puzzle is almost good enough to be included among conjuring tricks, but as there is neither magic nor sleight of hand involved, there is no alternative but to place it here. The puzzle seems ridiculous and unreasonable, as in performing it neither the coat nor vest may be torn, cut, or damaged, nor may either arm be removed from the sleeve of the coat. The puzzle cannot always be performed, as it depends upon the size of the coat-sleeves allowed by the fashions of the day, though as a rule a coat with suitable sleeves will be found in most households. The person whose waistcoat has to be removed should be the wearer of a coat the sleeves of which are sufficiently large at the wrist to admit of the hand of the operator being passed up and through them. Any person undertaking to perform the puzzle in a drawing-room should first request some one of the company to remove his evening coat, and to replace it by a light spring overcoat; this being done, it will be easy to carry out the following instructions: The waistcoat should first be unbuttoned in the front, and then the buckle at the back must be unloosed. The operator, standing in front of the person operated upon, should then place his hands underneath the coat at the back, taking hold of the bottom of the waistcoat, at the same time requesting the wearer to extend his arms at full length over his head. Now raise the bottom part of the waistcoat over the head of the wearer (if the waistcoat be tight it will be necessary to force it a little, but this must not be minded so long as the waistcoat is not torn); the waistcoat then will have been brought to the front of the wearer, across his chest. Take the *right* side bottom-end of the waistcoat, and put it into the arm-hole of the coat at the shoulder, at the same time putting the hand up the sleeve, seizing the end, and drawing it down the sleeve; this action will release one arm-hole of the garment to be removed. The next thing to be done is to pull the waistcoat back again out of the sleeve of the coat, and put the *same* end of the waistcoat into the *left* arm-hole of the coat, again putting the hand up the sleeve of the coat as before, and seizing the end of the garment. It may then be drawn quite through the sleeve, and the puzzle is accomplished.

TO BREAK A STONE WITH A BLOW OF THE FIST.

To do this two stones are required, each one of which should be from three to six inches in length, and about half as thick. Place one of the stones flat, firmly and immovably, upon the ground, and on it place one end of the other stone, raising the opposite end to an angle of something like forty-five degrees, and just over the centre of the lower stone, with which it must form a T, being kept in that position by a piece of twig or stick of the necessary length. The top or elevated stone should then be smartly struck at about the centre with the little-finger side of the hand; the stick, of course, will give way, and the bottom stone will be broken to pieces.

THE KEY, THE HEART, AND THE DART.

This is a very old-fashioned puzzle, and easy of accomplishment to those who know how to do it. The puzzle is either to arrange the three articles in an apparently inextricable manner, or, if they are so arranged, to separate them without damaging either, or bending the cardboard out of which they should be made.

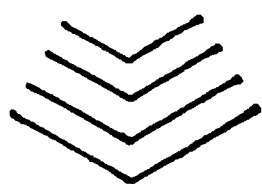


Fig. 18.

Cut out of some tough and elastic cardboard a double-headed dart, a key, small at the ring end, and a heart, in which should be cut four angular slits, shaped as in Fig. 18. To arrange them together, the lowermost cut in the heart must be pressed out so that it will form a loop, through which the ring end of the key has to be drawn, and so that one end of the dart may also be passed through without breaking the cardboard. Then fold the dart in the middle, so that one of its heads shall accurately fit upon the other head; bring the loop of the heart back into its former position, drawing it out of the ring of the key, which should then glide down the shaft of the dart, and hang fast held by the head. To disentangle the articles, reverse the order of procedure.

THE PRISONERS' RELEASE PUZZLE.

Take two pieces of string or tape, and round the wrists of two persons tie the string, as shown in Fig. 19. It adds to the amusement of the puzzle if one of the persons is a lady and the other a gentleman. The puzzle is for them to liberate themselves, or for any one else to release them without untying the string. To do this, B makes a loop of his string pass under either of A's manacles, slips it over A's hands, and both will be free. Reverse the proceeding, and the manacles are again as before.

As a finish to the Mechanical Puzzles, we will give the key to the world-renowned

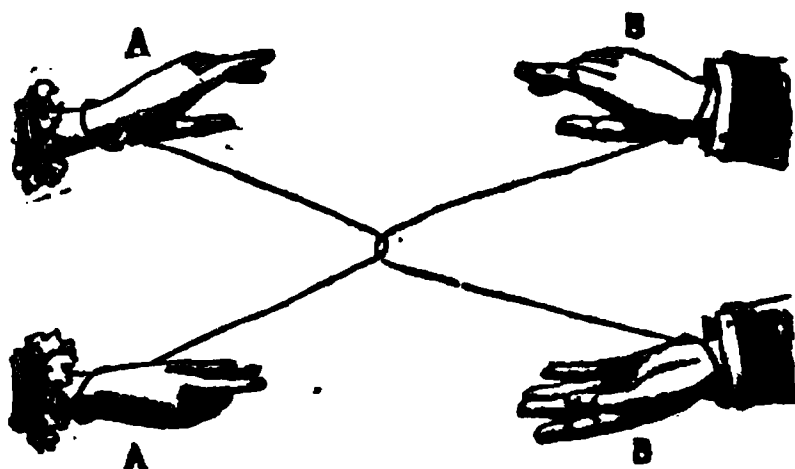


Fig. 19.—THE PRISONERS' RELEASE PUZZLE.

HAMPTON COURT MAZE.

Upon entering the maze, turn to the right; afterwards, whenever there is a choice between the left and right, turn to the left, and the centre will soon be reached. Reverse the process in coming out.

ARITHMETICAL PUZZLES.

UNDER this heading we propose to give some arithmetical puzzles, to speak of the power of different numbers, to show some of the curious combinations of which numbers are capable, and generally to give such examples as our space will admit to explain how the science of numbers may be made to do service for our amusement.

Among the most popular of number puzzles are the

AMERICAN PUZZLES "15" AND "34,"

which have been christened "Boss." The materials of the puzzles are very simple, a description that may indeed be applied to all the amusements dealt with in this section. The puzzles, as purchased, consist of a square box of sixteen small wooden cubes, numbered from 1 to 16. The box of cubes may be purchased in the streets for a very trifling sum, or it may be obtained in the toy-shops in a more elaborate form, but still at a small cost. The popularity of the game may be guessed from the statement made by a New York toy-dealer to the effect that in one day he disposed of no less than 230 gross of a cheap variety. In London, street toy-vendors by the score sold them all day long for weeks together when they were first introduced, and a leading toy-dealer in the fashionable neighbourhood of Regent Street says the number sold retail from his shop daily was enormous. Their popularity in other countries is equally great.

The puzzle is twofold, and is described in the following quaint and curt manner in the little boxes sold in the streets :—

The Puzzle of Fifteen.—"Remove the 16 block. Put the pieces in the box irregularly, and arrange them to regular order by shoving."

The Magic Sixteen, or the Puzzle of Thirty-four.—"Arrange the sixteen blocks so that the sum of the numbers added up in any straight line, either vertical, horizontal, or diagonal, will be 34."

It would appear that the "15" puzzle has the merit of being entirely new, a claim to which the "34" puzzle has no sort of right, it being found in many books of old and recent date. It is believed that there are in all sixteen different ways of arranging the numbered blocks so that the sum of the numbers will be 34 in every direction; but two ways will suffice to quote here, and they are as

1	14	15	4
8	11	10	5
12	7	6	9
13	2	3	16

FIG. 1.—A SOLUTION OF THE "34" PUZZLE.

shown in Figs. 1, 2. The fascination and popularity of "Boss," however, all centre around the "15" puzzle; it is the solution of that which is said to have sent some people mad, to have made more forsake their ordinary occupation, and which claims to have given to a still larger and ever growing number of human beings a new incentive to life. The puzzle is fairly stated above in the words, "Put the pieces in the box irregularly," &c.

1	15	14	4
12	6	7	9
8	10	11	5
13	3	2	16

FIG. 2.—ANOTHER SOLUTION OF THE "34" PUZZLE.

As a first attempt, however, place the pieces as arranged when the "34" puzzle has been solved, and the "15" puzzle may be easily accomplished after a little practice. To describe the various moves would be unnecessary, but the object first to be aimed at is to get the first row of cubes, viz., 1, 2, 3, 4, into their proper places, attention being next directed to getting the 12 cube into its place; that cube will have to be again moved before all the cubes have been consecutively

arranged, but it should always be kept as near to its proper position as possible. The cubes, when arranged, should read as follows (Fig. 3):—

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	

Fig. 3.—"15" PUZZLE—THE CUBES IN ORDER.

"Boss," or the real American puzzle of "15" is to place the numbered cubes, as shown in Fig. 4, in the box, and then to arrange them, by sliding and without lifting any one cube, so that they shall read consecutively. It may at once be said that the American puzzle has never yet been solved. But why? is asked by every one, and every one tries to solve it. Articles on the puzzle have appeared in many periodicals, but no one has had the hardihood to publish a solution of the American puzzle. An ingenious calculator has stated that the fifteen cubes may

1	2	3	4
5	6	7	8
9	10	11	12
13	15	14	

Fig. 4.—"15" PUZZLE—THE CUBES SET FOR SOLUTION.

be arranged in the box in 1,307,674,318,000 different combinations, and that it would take one individual a whole year to work out 105,000 of these arrangements, if only one arrangement was worked out every five minutes. Let the reader calculate at what remote period the whole of the different orders could be tested to see whether the "15-14" combination could be overcome. It seems to have been decided that there are a certain number of the combinations that can be solved, and that there are a certain number that cannot, and that the number of each is equal. If, when the fifteen cubes are placed in the box, the number of transpositions required to place the cubes in proper consecutive order is even, the puzzle may be solved; but if the number of transpositions required is odd, the puzzle cannot be solved. For example: take the first solution of the "34" puzzle (Fig. 1), and it will be found that six transpositions are required to place the numbers in the proper order, viz.:—

- | | |
|-----------------------|-----------------------|
| 1. Transpose 14 and 2 | 4. Transpose 11 and 6 |
| 2. " 15 " 3 | 5. " 10 " 7 |
| 3. " 8 " 5 | 6. " 12 " 9 |

The number of transpositions being even, the puzzle is soluble; with the "15-14" order, there being only one transposition necessary, or an odd number, the puzzle is insoluble. With this information and a little practice any player may tell at a glance when any combination of the figures is shown whether the puzzle is soluble or no.

After the above lengthy dissertation on these clever puzzles we will now proceed to minor topics which may be treated as arithmetical amusements.

THE MAGIC NINE, OR THE PUZZLE OF FIFTEEN.

2	9	4
7	5	3
6	1	8

Fig. 5.—THE MAGIC NINE.

To arrange the numbers 1 to 9 in three rows, so that the sum of each row added together horizontally, vertically, or diagonally shall be 15. Fig. 5 shows how the arrangement has to be made.

THE MAGIC THIRTY-SIX, OR PUZZLE OF ONE HUNDRED AND ELEVEN.

This puzzle is similar in principle to the preceding one, and consists in so arranging the numbers 1 to 36 in six rows that the sum of each row, added together horizontally or vertically, shall be the same (Fig. 6). The sum of the rows will be found to be 111.

8	30	27	10	25	11
35	6	33	34	1	2
17	13	22	21	24	14
20	19	16	15	18	23
5	31	4	3	36	32
26	12	9	28	7	29

Fig. 6.—MAGIC THIRTY-SIX.

There is a still more complicated puzzle of this class to be performed. It is called

THE MAGIC HUNDRED, OR THE PUZZLE OF FIVE HUNDRED AND FIVE,

This consists in arranging the numbers from 1 to 100 in ten rows, and in such a way that the sum of the numbers counted, horizontally, vertically, or diagonally, shall be 505, neither more nor less. This puzzle may be set when the Magic Nine, the Magic Fifteen, and the Magic Thirty-six have been solved. The key is printed in Fig. 7. Upon a close examination of the key the solution of the puzzle from memory will soon become quite an easy matter. Observe the rows are numbered on the right hand side from 1 to 5, commencing both at the top and at the bottom. It will be seen that the rows numbered 1 contain the numbers 1 to 10 and 91 to 100; the rows numbered 2 contain the numbers 11 to 20 and 81 to 90; the third rows contain all the numbers from 21 to 30 and from 71 to 80; the fourth rows contain the numbers 31 to 39 and 60 to 70, excluding 61, but including 41; in the fifth rows the numbers run from 42 to 59, and have also the numbers 40 and 61. Furthermore, note the lettered columns, and it will be seen that the unit figures in columns A are noughts and ones, in columns B twos and nines, in columns C threes and eights, in columns D fours and sevens, and in columns E fives and sixes.

A	B	C	D	E	E	D	C	B	A	
91	2	3	97	6	95	94	8	9	100	1
20	82	83	17	16	15	14	88	89	81	2
21	72	73	74	25	26	27	78	79	30	3
60	39	38	64	66	65	67	33	32	41	4
50	49	48	57	55	56	54	43	42	51	5
61	59	58	47	45	46	44	53	52	40	5
31	69	68	34	35	36	37	63	62	70	4
80	22	23	24	75	76	77	28	29	71	3
90	12	13	87	86	85	84	18	19	11	2
1	99	98	4	96	5	7	93	92	10	1

Fig. 7.—THE MAGIC HUNDRED.

THE TWENTY-FOUR MONKS.

During the middle ages there existed a monastery, in which lived twenty-four monks, presided over by a blind abbot. The cells of the monastery were planned as shown in the accompanying figure (Fig. 8), passages being arranged

1	2	3
4	ABBOT	5
6	7	8

Fig. 8. — THE TWENTY-FOUR MONKS.

along two sides of each of the outer cells and all round the inner cell, in which the abbot took up his quarters. Three monks were allotted to each cell, making, of course, nine monks in each row of cells. The abbot, being lazy as well as blind, was very remiss in making his rounds, but provided he could count nine heads on each side of the monastery he retired into his own cloister, contented and satisfied that the monks were all within the building, and that no outsiders were keeping them company. The monks, however, taking advantage of their abbot's blindness and remissness, conspired to deceive him, a portion of

their number sometimes going out and at other times receiving friends in their cells. They accomplished their deception, and it never happened that strangers were admitted when monks were out, yet there never were more nor less than nine persons upon each side of the building. Their first deception consisted in four of their number going out, upon which four monks took possession of each of the cells numbered 1, 3, 6, and 8, one monk only being left in each of the

other cells; nine monks being thus on each side of the building. Upon returning, the four monks brought in four friends, when it was necessary to arrange the twenty-eight persons, two in each of the cells 1, 3, 6, and 8, and five in each of the others; still nine heads only were to be counted in either row. Emboldened by success, eight outsiders were introduced, and the thirty-two persons now were arranged one only in each of the cells 1, 3, 6, and 8, but seven in each of the other cells; again, according to the abbot's system of counting, all was well. In the next endeavour, the strangers all went away and took six monks with them, leaving but eighteen at home to represent twenty-four; these eighteen placed themselves five in each of the cells 1 and 8 and four in each of the cells 3 and 6; the remaining cells were empty, but the cells on each side of the building still contained nine monks. On returning, the six truants each brought two friends to pass the night, and the thirty-six retired to rest, nine in each of the cells 2, 4, 5, and 7; the remainder were empty, and the abbot was quite satisfied that the monks were alone in the monastery.

TO TAKE ONE FROM NINETEEN, SO THAT THE REMAINDER SHALL BE TWENTY.

See how it is done: XIX. (nineteen), by taking away the one that stands between the two tens (XX.), twenty will remain.

A similar catch is to write down nine figures, the sum of which is 45, from that number to take away 50, and to let the remainder be fifteen. The numerals should be added together thus: $1+2+3+4+5+6+7+8+9=45$, or XLV., from which take away L. (50), and there will be left XV. (15).

THE FAMOUS FORTY-FIVE.

The number 45 can be divided into four such parts that if to the first 2 is added, from the second 2 is subtracted, the third is multiplied by 2, and the fourth divided by 2:— the total of the addition, the remainder of the subtraction, the product of the multiplication, and the quotient of the division will be the same.

The first part is	8,	to which add 2, and the total will be	10
The second is	12,	from which subtract 2, and the total will be	10
The third is	5,	which multiply by 2, and the result will be	10
The fourth is	20,	which divide by 2, and the result will be	10
45			

Again, 45 may be subtracted from 45 in such a manner as to leave 45 for a remainder. Arrange the following figures, add the rows together, and each row will be 45; subtract the bottom row from the top row, and the sum of the result added together will also be 45.

$$\begin{array}{r}
 9+8+7+6+5+4+3+2+1=45 \\
 1+2+3+4+5+6+7+8+9=45 \\
 \hline
 8+6+4+1+9+7+5+3+2=45
 \end{array}$$

THE COSTERMONGER'S PUZZLE.

A costermonger bought 120 oranges at two for a penny, and 120 more at three for a penny, and mixed the oranges all together in a basket. He sold them out, hoping to receive back his money again, at the rate of five for twopence; but on counting his money he found that he had sold the oranges for fourpence less than they had cost him. How this happened will be seen by following the accompanying figures. The first forty purchasers of the oranges would take 200 out of the 240 oranges, and taking it for granted that the fruit was equally mixed, would receive for their money 100 of the oranges originally bought at two a penny

and 100 of those at three a penny, and would pay for them the sum of 6s. 8d. The forty remaining oranges would bring in, at the same rate, 1s. 4d. only, making 8s. in all. The cost of the fruit was, for the first 120, 5s., and for the second 120, 3s. 4d., or 8s. 4d. in all, making the loss of 4d. on the lot. To more fully explain the matter, we will suppose the oranges not mixed, but standing in separate baskets, from which, for each purchaser, the costermonger takes two of the two a penny oranges and three of the three a penny oranges, disposing of them in that way for twopence; it will then be clearly seen that the basket containing the three a penny oranges will be first exhausted, for the first forty purchasers, each having three oranges from one basket, will take all the 120 oranges purchased at three a penny, but will require only 80 oranges from the other basket, thus leaving 40 of the two a penny oranges to be sold at five for twopence, or a loss of fourpence on the last 40 sold.

THE PROGRESSION OF NUMBERS.

An illustration of the progression of numbers may be gathered from the description given of the American puzzle of "15," at the commencement of this section on *Arithmetical Amusements*. It is there stated that the different number of combinations or different arrangements of the fifteen cubes that can be made are 1,307,674,318,000. The reader may prove this for himself in the following manner:—The number of combinations that can be made with two cubes is 2, of three cubes 6, of four cubes 24, of five cubes 120, of six cubes 720, and so on, multiplying the result each time by one number higher than the previous result was multiplied by, until the amazing total quoted is reached; the arrangement of the cubes in rows and columns introducing additional variations of combinations. There are numerous instances on record in which it is stated that advantage has been taken of the known progression that ensues upon a repeated doubling of a given result. The *Horse-dealer's Bargain* is frequently quoted. A horse-dealer having a horse to dispose of, to which a gentleman had taken a great fancy, was asked to name any price he thought fit. Wishing at the first blush to appear generous, he offered to sell his horse, calculating its price according to the number of nails that were used to fasten on the four shoes, a farthing being allowed for the first nail, a halfpenny for the second, a penny for the third, twopence for the fourth, and so on. Upon examination it was found that it took six nails to fasten on each of the shoes, making in all twenty-four nails. The amount arrived at by repeatedly doubling the amount until the twenty-fourth nail had been allowed for was £8,738 2s. 8d.

The story of the *Sovereign and the Sage* gives a still more wonderful result. A king once, anxious to reward one of his subjects for valuable services performed to the State, asked in what way the subject would take his recompense. The king and the subject were both sixty-four years of age, and the wise man asked that he might be granted a kernel of wheat for the first year of their lives, two for the second, four for the third, eight for the fourth, sixteen for the fifth, and so on. By continuing the calculation until the result has been doubled for the sixty-fourth time, the astounding number of 9,223,372,036,854,775,808 will appear. It is generally conceded that the average number of wheat kernels in a pint is 9,216, which will give 18,432 for a quart, 73,728 for a peck, and 589,824 for a bushel, or 31,274,997,411,298 bushels of grain as the courtier's reward for his services, a larger amount than the whole world would produce in several years.

The *Pin in the Hold of the "Great Eastern" Steamship* is comparatively a modern calculation, based on this principle. It is calculated that 200 pins go to the ounce, and that if for the fifty-two weeks in the year one pin were

dropped into the hold during the first week, two in the second, four in the third, and so on, that by the end of the year the weight of the whole would be no less than 628,292,358 tons of pins. As the *Great Eastern* steamship was built to carry 22,500 tons only, it follows that to carry all the pins there would be required 27,924 ships of the size of the *Great Eastern*.

As a last illustration of this subject we will instance the feat of counting a billion, which all boys know is a million millions. Allowing that so many as 200, which is an outside number, could be counted in a minute, it would, excluding the 366th day in leap years, take one person upwards of 9,512 years before the task would be completed. It is not, therefore, probable that any one person has yet counted a billion.

We next proceed to give a few of the rules showing

HOW A NUMBER THOUGHT OF OR OTHERWISE INDICATED MAY BE TOLD.

These rules and puzzles are numerous, and in practising them in company it is well to have several methods at command, in order that those of the company not in the secret may be the more mystified; and, indeed, those who only know one or two ways will themselves be astonished if they see others proceeding on principles differing from those with which they are familiar.

The Cancelled Figure.—Write down on a slate a series of numbers, the sum of each of which shall be 9: such, for example, as 18, 27, 36, 45, 144, 234, 612, 711, 252, 342, 261, 360, 432, 315, &c. &c. The greater the variety the better. Tell some person to fix on two of these numbers, and after adding them together, to strike out any one of the figures of the result, and then, upon his stating the sum of the remaining figure or figures, the figure struck out may be arrived at by ascertaining the difference between that sum and 9 or 18, according to whether the sum is less or more than 9. If the sum remaining be 9, the figure struck out will have been 9. Suppose, for instance, the numbers selected are 711 and 252, the total of which will be 963; if the figure struck out of that number be 6, the sum of the two remaining figures will be 12, or 6 less than 18. Again, take the numbers 18 and 27, making a total of 45; strike out the 5, and it will be seen that the difference between 4 and 9 is 5.

In the following methods any number may be thought of, and the subsequent calculations are to be mentally or otherwise made by him thinking of the number.

First Method.—Instruct that the number thought of be multiplied by 3, that 1 be added to the result, the result again being multiplied by 3, to which result the number first thought of has to be added; ask the result, strike off mentally the final figure, which will be a 3, and the figure or figures then left will represent the number first thought of. For example:—

The number thought of is	..	..	..	..	11
Multiplied by 3, it is	..	..	..	..	33
Add 1	..	..	..	..	34
Multiply by 3	..	..	..	..	102
Add the number (11) thought of	..	..	..	..	113

The result of which, when told, will show 11 to be the number thought of.

Second Method.—Let any number be thought of, which we will again suppose to be

again suppose to be	..	..	..	..	11
Instruct that it be doubled	..	..	..	..	22
Instruct that some stated even number be added	..	..	..	..
(say 54)	..	..	..	..	76
Let the result be halved	..	..	..	..	38
Deduct the number first thought of (11)	..	..	..	..	27

The result will always be the half of the number that was instructed to be added.

Third Method.—Multiply the number thought of by itself (say 11). 121
 Take 1 from the number thought of, and multiply
 the result by itself (10+10) 100
 Ask the difference between the two results .. 21

To this number the player, who is exhibiting his powers, must mentally add 1=22, and divide that number by 2, which gives 11, the number thought of.

Fourth Method.—Add 1 to the number thought of (again 11) .. 12
 Multiply by 3 36
 Add 1 37
 Add the number thought of (11) 48

Ask the result, from which mentally subtract 4, and divide the result by 4, which will again correctly give the original number.

Fifth Method.—Let the number (11) thought of be doubled .. 22
 Add 4 26
 Multiply by 5 130
 Add 12 142
 Multiply by 10 1,420

Ask the result, from which mentally deduct 320, giving 1,100, from which strike off the noughts, and the result is again as before.

Sixth Method.—Let 1 be deducted from the number (11) thought of 10
 Multiply by 2 20
 Add number first thought of 31

Ask the result, and to it mentally add 3=34, divide by 3, and the quotient of full numbers will be the number thought of. The above methods of guessing a number thought of will be about as many as any lad can remember.

MAGICAL ADDITION.

The following is a peculiar arrangement of the figures 1 to 9, so that by adding them together they amount to 100:—

$$\begin{array}{r} 15 \\ 36 \\ 47 \\ \hline 98 \\ 2 \\ \hline 100 \end{array}$$

To find the sum-total of three lines of figures upon the first line being shown, let any one write down a row of figures, and suppose they are 76854. Then take the paper, and, leaving space for two more rows of figures, say that the result of the addition of that row with two other rows can be given, the first of which rows may be written by any one present. Proceed by deducting 1 from the final right-hand figure, and place the figure 1 on the left-hand side; let the top row be folded over, and the paper handed back for the second row to be written, which we will suppose to be 34721; fill in the third row by making each figure in the second row up to 9 by writing 65278; the figures given according to the instructions will be the addition of the three rows.

$$\begin{array}{r} 76854 \\ 34721 \\ 65278 \\ \hline 176853 \end{array}$$

The addition of five rows of figures may be told in a similar manner. Let any one present write down, as before, a row of figures, and then the calculator may

undertake to tell the addition of that row with four other rows, two of which may be written by any person or persons present. This is attained by deducting 2 from the unit figure, and placing the figure 2 on the left-hand side. For example: again suppose the first row to be as before (76854); the result of the addition of that row and four others may be made to be 276852. After the first row has been written, fold it over, and request some one to write a second row of figures, which shall be supposed to be 34721; to this the magic calculator should write for the third row such figures as will make each of the above up to 9, namely, 65278; again, let a stranger write the fourth row, first turning over so as to conceal the second and third rows; whatever appears for the fourth row must be in each figure, as before, for the fifth row, made by the calculator to 9. Thus, if the fourth row be put down 80765, the necessary figures to add for the fifth row will be 19234, when the previously given total will be found to be correct.

$$\begin{array}{r}
 76854 \\
 34721 \\
 65278 \\
 80765 \\
 19234 \\
 \hline
 276852
 \end{array}$$

In the last two examples of *Magical Addition* the only stipulations needed are that no subsequent row shall contain more figures than are contained in the first row, and that the first row shall end neither with a 1 nor a 0.

THE CLEVER LAWYER.

The following good story is very old:—A country attorney was once left executor to a will in which the testator bequeathed his stable of horses to be divided among three persons, in the proportions of half of the horses to A, a third of the horses to B, and a ninth of the horses to C. When the will was made 18 horses were in the stable, but subsequently, and before the death of the testator, one died, leaving but 17. The division according to the will now seemed impossible; but to prevent disputes among the legatees, the lawyer gave a horse out of his own stable, then divided the horses according to the will, and yet received his own back, and all were satisfied. It was done in the following manner:—

A received the half of 18, namely	..	..	..	9 horses.
B " third "	..	..	..	6 "
C " ninth "	..	..	..	2 "
				<hr/>
				17
The lawyer's horse returned	..	..		1
				<hr/>
				18

A NEW WAY OF MULTIPLYING BY 9.

Suppose it be required to multiply the following figures by 9, the result may be obtained in the following as well as in the ordinary way. In the first example the ordinary method has been pursued; the new way consists in adding a 0 on the right-hand side of the figures, and subtracting the number to be multiplied.

$ \begin{array}{r} 467543 \\ 9 \\ \hline 4207887 \end{array} $		$ \begin{array}{r} 4675430 \\ 467543 \\ \hline 4207887 \end{array} $
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TO REWARD THE FAVOURITES, AND SHOW NO FAVOURITISM.

The proprietor of a ladies' school once received an invitation for one-half of her pupils to attend a flower show, but was a long time before she could decide how to pick out those who ought to be rewarded without hurting the feelings of those left behind. There were thirty pupils in the school, and fifteen were to be taken and the like number left at home. The following plan was the one hit upon:—The pupils were arranged in a row, four intended to go were placed first, five not intended next, and so on, as shown below, the letter A denoting those it was intended should partake of the offered pleasure, the letter B denoting those it was wished to leave out, and they were told when so arranged that the ninth girl, and each succeeding ninth, would be left at home.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	A	A	A	B	B	B	B	B	A	A	B	A	A	A	B	A	B	B	A	A	B	B	B	A	B	B	A	A	B

The counting commenced with No. 1, and went round and round consecutively, each ninth pupil being dropped out, as designated to stay at home. It will be seen that those to be left were dropped out in the following order:—9th, 18th, 27th, 6th, 16th, 26th, 7th, 19th, 30th, 12th, 24th, 8th, 22nd, 5th, 23rd, thus leaving fifteen only.

THE DISHONEST SERVANTS.

Three gentlemen, with their servants, had to cross over a river in a boat in which two passengers only could be transported at one time. The servants were known to have planned to murder and rob one or more of the masters if two servants were left with one master or three servants with two masters. The question to be decided was how these six persons were to cross so that the boat could be returned, and yet so that the servants on either side of the river should not outnumber the masters. The following is one of the several ways in which the difficulty might have been overcome:—Two servants go over first, one returns; two servants go over again, one again returning with the boat; two of the masters next go over, and a master and one of the previously taken servants returns; then two of the masters again go over, and the servant already crossed takes the boat back, leaving the three masters safely crossed; the servants are left to come over in any manner they choose.

LORD DUNDREARY'S FINGER PUZZLE TO COUNT ELEVEN FINGERS ON THE TWO HANDS.

Begin on one hand, and count the ten fingers throughout. Begin next time at the finger last counted in the first round, counting this time backwards—ten, nine, eight, seven, six—then holding up the other hand, say “And five are eleven.”

UNIFORM RESULTS OF MULTIPLICATION.

The digits 15373 multiplied by 7 give	..	..	11111
“ 31746 “ 7 “	..	..	22222
“ 47619 “ 7 “	..	..	33333
“ 63492 “ 7 “	..	..	44444
“ 79365 “ 7 “	..	..	55555
“ 95238 “ 7 “	..	..	66666
“ 126981 “ 7 “	..	..	88888
“ 142857 “ 7 “	..	..	99999
Of course, it would need the digits 11111 × 7 to make			77777

TO ASCERTAIN A SQUARE NUMBER AT A GLANCE.

Every boy knows that a square number is a number produced by the multiplication of any number into itself; thus 7, multiplied by itself, gives 49 as a result, 49 consequently is a square number, 7 being termed the square root from which it springs. In high numbers the extraction of the square root is an affair of time and trouble, and after all the necessary calculations have been made it may perhaps be found that the number is not a square number. This unnecessary trouble may be saved if the following instructions are remembered:—Every square number ends with one of the figures 1, 4, 5, 6, or 9, or with two ciphers preceded by one or other of those figures. Again, every square number is either equally divisible by 4, or when divided by 4 will have a remainder of 1; thus, as shown above, the square of 7 is 49, which divided by 4 gives us a quotient 12 and 1 over; 64 again is a square number, and it is exactly divisible by 4.

TO DISTINGUISH COINS BY ARITHMETICAL CALCULATION.

Request some person to place in one of his hands a bronze coin and in the other a silver one, and to let no one know which hand contains either particular coin. This may be ascertained by the following calculation:—The calculator should assign an even number, say 4, to the bronze coin, and an odd number, say 7, to the silver coin. The person holding the coins should be requested to multiply the number assigned to the coin held in his right hand by an even number, and that assigned to the coin held in the left hand by an odd number. Instruct that the products of the two calculations be added together, and if the whole sum be even the silver coin will have been placed in the right hand, and the bronze coin in the left. If the result be an odd number, the reverse arrangement will of course have been made.

We will conclude this section by stating shortly some of the

PROPERTIES OF NUMBERS.

By a careful study of these properties many amusing arithmetical puzzles and numerical combinations may be arrived at:—

1. Every odd number multiplied by an odd number produces an odd number.
2. Every odd number multiplied by an even number produces an even number.
3. Every even number multiplied by an odd number produces an even number.
4. An even number added to or subtracted from an even number, or an odd number to or from an odd number, produces an even number.
5. An odd number added to or subtracted from an even number produces an odd number.
6. The digits of the nine times multiplication table added together make either 9 or 18 (twice 9), thus:—

$$\begin{array}{rcl}
 9 \times 1 & = & 9 \\
 9 \times 2 & = & 18 \text{ or } 8 \text{ plus } 1 = 9 \\
 9 \times 3 & = & 27 \text{ or } 7 \text{ ,, } 2 = 9 \\
 9 \times 4 & = & 36 \text{ or } 6 \text{ ,, } 3 = 9 \\
 & & \text{And so on to} \\
 9 \times 11 & = & 99 \text{ or } 9 \text{ plus } 9 = 18
 \end{array}$$

Then so on again up to 9 times 24, each table making 9, with the exception of 9 times 21 = 188 = 8 + 9 + 1 = 18. Indeed, the digits, added together, of the product of any number multiplied by 9, will be found to be 9 or a multiple thereof.

7. The digits 1 to 9 may be placed to form 362880 combinations; this number divided by 9 gives 40320; these figures added together make 9.

8. If two numbers are divisible by any one number, their sum and their difference will also be divisible by the same number.

9. If two numbers divisible by 9 be added together, the sum of the figures will be either 9 or a multiple of 9.

CARD GAMES.

TERMS USED IN CARD GAMES.

BEFORE proceeding to describe the various games played with cards, it will be as well to explain, for the benefit of the novice, a few technical terms which are more or less common to all such games, and which we shall have frequent occasion to use in our descriptions.

SHUFFLING signifies the mixing of the cards prior to a new game or round, so as to break up the order in which they have been left by previous play.

CUTTING signifies the dividing of the cards into two portions, still further to disturb their order. In two-handed games the cards are cut by the dealer's opponent; in other games by the person to the right of the dealer. The upper part of the pack is lifted off, and the lower placed upon it.

Cutting is also used as a method of deciding which player shall deal, or in four-handed games, such as Whist, which of the players shall join as partners. In this case each player lifts off a portion of the pack, and shows the undermost card of each portion. The lowest card cut gives, in most games, the right to deal. In cutting for partners, those cutting the two highest cards play against those cutting the two lowest. In cutting, ace is always regarded as the *lowest* card.

DEALING is the act of distributing the cards—part or the whole, as the case may be—according to the rules of the particular game.

The **ELDER HAND** is the name given in two-handed games to the opponent of the dealer; in other cases to the player seated to the dealer's left.

The **STOCK** (sometimes called by its French name, the *Talon*) is the undistributed portion of the pack where, as at *Piquet* or *Ecarté*, part only of the cards are dealt to the players.

DISCARDING signifies (in games where such a licence is allowed) the throwing out of one or more cards, their place being supplied by others from the stock. At Whist and other games where the player is required to follow suit, the term has another meaning, signifying the playing of a card of some suit other than the suit led, or the trump suit.

SINGLETON is a term used, more particularly at Whist, to denote a card which stands "single" in the hand of the player, he having received by the deal no other of that suit.

FOLLOWING SUIT.—If a later player plays a card of the same suit as the card led, he is said to follow suit. In some games each player is bound to follow suit if he can. In others he may do so or not, as he pleases.

REVOKE.—A player failing to follow suit, in cases where it is the rule of the game that he should do so, is said to *revoke*, and is subject to various penalties, according to the laws governing the game in question.

HEADING THE TRICK.—In some games the player is required, not merely to follow suit, but, if he can, to play a higher card than any as yet played. In such case he is said to "head the trick."

TRUMPS.—In many games a paramount value is, for the time being, given to some one suit, usually determined by turning up the card next following after each player has received his quota. Such suit is termed the *trump* suit, and cards of such suit, however small, are superior in winning power to those, however large, of any other. The non-trump suits for the time being are known as *plain* suits, and a card of any such suit as a *plain* card. A person playing a trump card to a plain suit led is said to trump.

Other technical terms will be explained in connection with the games in which they are used.

ALL FOURS.

THIS game derives its name from the four chances, or points, of which it consists—namely, *High*, which is the name given to the best trump; *Low*, the smallest trump; *Jack*, the knave of the trump suit; and *Game*. The game

may be played by either two or four players, the same rules, with slight variations, applying in either case.

It will be as well first of all to explain the above terms a little more minutely.

High.—The highest trump played during the hand; the holder scores one point.

Low.—The lowest trump played during the hand; the original holder of it scores one point, even though it be taken by his adversary.

Jack.—The knave of trumps; the holder scores one point, unless the card be taken by his adversary, in which case the winner scores the point.

Game.—One point, scored by the player who can show in the tricks won by him the greatest number, reckoning as follows:—

Each ace, *four*.
 „ king, *three*.
 „ queen, *two*.
 „ knave, *one*.
 „ ten, *ten*.

The other cards do not count towards Game.

The game is played as follows:—

The ace is the highest card, and deuce is the lowest.

After having cut and shuffled a pack of fifty-two cards in the ordinary way, the dealer gives six to each player, turning up the thirteenth card for trump. (With four players he turns up the twenty-fifth card.) Should the turn-up be a knave, the dealer scores one point.

The elder hand then looks at his cards, and decides whether he will play or *beg*. In the latter case the dealer must either allow him to score one point, or give three more cards to each player, and turn up a new trump. Should the new turn-up be of the same suit as the last, the dealer must go on giving three more cards until a change of trumps takes place.

The elder hand having decided on his game, plays a card from any suit he likes; to this the dealer plays another card, which, if higher, wins the trick, the winner leading to the next trick, and so on throughout the six tricks. The highest card of the suit led wins, unless the trick is trumped. A player may trump, even though holding cards of the suit led, but if in such case he neither follows suit nor trumps, he is guilty of a revoke, the penalties for which are as under:—

1. If the player making the revoke makes Jack and Game, he cannot score either; but his adversary may add both points to his own score.

2. If the player making the revoke makes either Jack or Game when both points are out, he cannot score the point, but the adversary may add two to his score.

3. If both Jack and Game are out, and the revoking player holds Jack, but does not make it, his adversary may score two points.

4. If Jack is not out, his adversary scores one point for the revoke.

5. If a player revokes, he cannot win the game that hand (i.e., where the game is played seven up, he cannot pass the point of six).

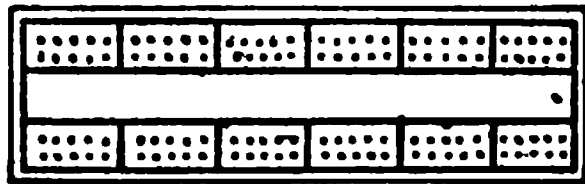
When the six tricks are played, the points are taken for *High*, *Low*, *Jack*, and *Game*. The score is reckoned in the above order; so that a player wanting only one point, and scoring High, is the winner, even though his adversary, also wanting one only, be entitled to score all the other items. The deal is taken in turns, and the player who first scores seven is the winner. The game is, however, sometimes made *nine* or *eleven*.

Should no player have either a court card, ace, or ten, the elder hand scores the point for *Game*; in the case of two players having equal points towards *Game*, the elder hand (see Technical Terms) of the two scores. If only one trump should be out, it counts both High and Low to the player who has it. The science of the game consists, as may easily be seen, first, in winning the knave; secondly, in securing the tens and such other cards as may score towards *Game*.

CRIBBAGE.

CRIBBAGE may be played by two, three, or four players, the two-handed game being the most frequently played. Of this, again, there are three varieties, known as five-card, six-card, and seven-card cribbage respectively. The latter is, however, rarely played; and of the two former, five-card cribbage is regarded as the more scientific, and practically the standard game. We shall therefore first give a description of this, followed by a brief account of the other varieties.

Cribbage is played with the whist pack of fifty-two cards, and the game is won by the player who first scores sixty-one points. These points are marked on a special board known as a cribbage-board, in appearance as shown in the illustration. It will be observed that it has on both sides two rows of thirty holes, each row divided into groups of five, with a single hole between the double rows at one end. This is known as the "game-hole;"* and in scoring, both players begin from this end of the board. Two pegs (of ivory or bone) are given to each player to score with, and he uses them as follows:—



CRIBBAGE-BOARD.

Supposing the player's first score to be two, he places one of his pegs in the second hole of the outer row nearest himself, at the "game-hole" end of the board. If his next score be three, he counts that number of holes from the position of the first peg, and sticks the second peg in the foremost of such holes. If his next score be eight, he counts eight holes from the foremost peg, and there places the hindmost peg; and so on, each time shifting the hindmost peg the appropriate number of holes beyond the front peg. Each player goes up the outer and down the inner row on his own side.

Court cards at cribbage count as tens, except for "pairing" purposes, when they must be of precisely equal rank. Thus a queen can only be paired with a queen, and not with a king or knave. All other cards are reckoned according to the number of their pips. The ace, counting one, is the *lowest* card.

The players cut for deal, the lowest dealing. The cards having been shuffled, the non-dealer cuts. The dealer takes up the lower portion, and from it deals, one by one, five cards to each, beginning with his adversary. The remaining cards are laid on the other heap, between the players.

Each player now looks at his cards, and throws out (face downwards) two of them. These go to form what is called the "crib," which belongs to the dealer. The first deal is a slight advantage, and to counterbalance this the non-dealer is entitled at the outset of the game to score three holes.

The crib having been thrown out, the non-dealer again cuts the cards. The dealer takes the uppermost card of the lower portion, and places it face upwards on the top of the pack. This card is known as the "turn-up," or "start," and belongs for scoring purposes to both players. Should the card turned up be a knave, the dealer scores two points, known as "two for his heels." (This must be done before the dealer plays, or the right is forfeited.)

The players score in two ways: first, during the play of the hand, by making with the card last played a certain number, as *fifteen* or *thirty-one* (each of which scores two points), or a certain combination of cards, as—

A pair (two cards alike), scoring two points.

A pair royal (three cards alike), scoring six points.

A double pair royal (four cards alike), scoring twelve points.

* Most cribbage-boards are now made with a game-hole at both ends, so that the score can commence at either end.

A sequence (three or more cards in regular succession, independent of suit), scoring one point for each card.

If the player whose turn it is to play finds that he cannot do so without over-running thirty-one, he cries "Go," and his opponent then scores one point, first, however, playing such additional cards (if any) as he can without over-passing thirty-one. Any cards remaining in hand are not * played.

We proceed to illustrate the method of scoring as above by playing an imaginary game.

We will suppose that A and B are the players, B dealing, and that the original hands are as follows:—

- | | |
|--------------|---|
| A. | Knave of spades.
Six " "
Ace " "
Five of diamonds.
Five of clubs. |
| B. (dealer). | Five of hearts.
Five of spades.
Seven " "
Eight " "
Ace of diamonds. |

We will further suppose that A throws out for crib the six and ace of spades, and B the seven and eight of spades. The hands therefore now stand as follows:—

- | | |
|----|---|
| A. | Knave of spades.
Five of diamonds.
Five of clubs. |
| B. | Five of hearts.
Five of spades.
Ace of diamonds. |

A cuts to B, and the nine of spades is turned up by way of start.

A leads (say) the knave of spades.

B plays the five of hearts—making fifteen. He calls "fifteen-two," and scores *two* accordingly.

A plays the five of diamonds—calling twenty (the new total), and scores *two* for a pair.

B plays the five of spades, calling twenty-five, and scoring *six* for a pair royal.

A plays the five of clubs, calling thirty, and scoring *twelve* for a double pair royal.

B plays the ace of diamonds, calling thirty-one, scoring *two* for completing that number. The other cards are not played.

A has thus scored *in play*, as it is termed, fourteen, and B ten. But it remains to be seen what they can score by their cards, this being a separate operation. A, as non-dealer, has "first show." Each of his fives combines with the knave to form fifteen, which he claims by saying "fifteen-two—fifteen-four." The two fives form a "pair" (two more), and the knave *being of the same suit as the turn-up card*, he scores one point additional for this, known as "one for his nob." In all, seven points.

B has fifteen-four, for each of his fives combines with his ace and the nine of spades, the "start" (which, as we have before stated, is counted with each player's hand), and he also scores two for his pair of fives. The crib also belongs to B, as dealer, and here he is more fortunate. The crib consists of the ace, six, seven, and eight of spades, and the turn-up is the nine of the same suit. Now, seven and eight make fifteen, likewise ace, six, and eight, likewise six and nine. B counts accord-

* Five-card herein differs from six-card cribbage. At the latter game the non-scoring player, after a "go," leads again, and the cards are played right out.

ingly for these, fifteen-two, fifteen-four, fifteen-six. But he has also four cards (six, seven, eight, nine) in *sequence*, and for these he is entitled to four points. Furthermore, all the cards, both crib and turn-up, are of *the same suit*, and he accordingly marks *five* (one for each card) for a *flush*.

A flush can only be scored in *crib* when the turn-up is of the same suit as the rest; but in the case of a flush occurring in the *hand* of either player, this is not necessary. If the cards of the hand are alike in suit, a flush (of three) may be scored for them, notwithstanding that the start is of a different suit.

A now deals, and gives to B—

Seven of hearts.
Knave „ „
Three of clubs.
Seven of spades.
Six of diamonds.

And to himself—

Ace of hearts.
King of „ „
Five „ „
Nine of clubs.
Eight of diamonds.

B throws out for crib the knave of hearts and three of clubs, and A the king and five of hearts.

We may here pause to note a point of some importance as to throwing out for crib. As the crib belongs to the dealer, it is to his interest to throw out such cards as are likely to increase its value. Thus, bearing in mind the large number of tens and court cards in the pack, it is good policy in the dealer to throw out a five if he can, as he thereby gets a fair chance of one or more fifteens. If he can throw out a tenth card as well, he makes one fifteen a certainty. It is further to his advantage to throw out two cards of *same suit*, as this gives the possibility of a *flush*. Where this is impracticable, two like cards are good to throw out, as they already form a pair, which, if the opposite player chance to throw out a similar card, may become a pair royal. Cards in sequence are also good, inasmuch as a third card continuing the series at either end will be good for three points. A seven and eight are especially good cards to throw out, inasmuch as they secure a fifteen, and at the same time may form part of a sequence. Where two cards in sequence are not available, alternate cards, as six and eight or seven and nine, are good, as the intermediate card may be thrown out by the adversary, and so complete the sequence.

The non-dealer proceeds on the opposite principle, endeavouring where he can to “*balk the crib*”: i.e., to throw out such cards as are *least likely* to score. Thus he will not, if he can help it, throw out two cards of the same suit, for fear of facilitating a flush; or two cards near together, lest he should lay the foundation for a sequence. Fives and tenth cards are avoided for like reasons. It will often be found that these various considerations clash. In such case the player can only aim at the smallest of a choice of evils.

Reverting to the game, the hands of the players are now as follows:—

B's. Seven of hearts.
Seven of spades.
Six of diamonds.

And A's. Ace of hearts.
Nine of clubs.
Eight of diamonds.

A turns up the knave of diamonds, scoring "two for his heels" accordingly.

B leads the seven of hearts (in the hope that A may make a *pair*, when he would cap it with a *pair royal*).

A plays the eight of diamonds, calling fifteen, and scoring two points.

B plays the six of diamonds, calling twenty-one, and scoring three for a *sequence* (six, seven, eight).

A plays the nine of clubs, calling thirty, and scoring *four* for the new *sequence* (six, seven, eight, nine).

B cannot play without over-passing thirty-one, so says "Go."

A plays his ace of hearts, calling thirty-one, and scoring two points.

B's last card, the seven of spades, is not played.

B has now "first show," but can only score a "pair" (the two sevens), the "start" being here of no advantage to him. Had it chanced to be an *eight*, it would have increased the value of his hand to twelve: viz., fifteen-four (each of the sevens combining with the eight), two sequences of three each (six, seven, eight twice over), and a pair for the two sevens. A has not a single point. The turn-up card has not helped him beyond the "two for his heels" already taken. Had it been a *ten*, he would have scored three for a *sequence* (eight, nine, ten), or had it been a seven, he would likewise have scored three for a *sequence*, and two for a fifteen (seven and eight), in addition.

But A has yet to take the *crib*, consisting of the king, knave, and five of hearts, and the three of clubs. The last mentioned card does not affect the result, but the five combines with the two other cards and with the start (knave of diamonds) to produce three fifteens—scored as fifteen-six—and the knave of hearts combines with the knave of diamonds to form a *pair*—two points additional.

Each player deals alternately until the one or the other has scored sixty-one points, when the game is at an end.

We append a table of the leading scores which can be made *with four cards* (three in hand and the start).

	Points.
Four fives	20
Three fives and a ten	14
Two fours, a five, and a six	12
Two fives, a four, and a six	12
Two sixes, a five, and a four	12
Three threes and a nine	12
Three sixes and a three	12
Three sixes and a nine	12
Three sevens and an ace	12
Three sevens and an eight	12
Three eights and a seven	12
Three nines and a six	12
Six, five, and two fours	12
Six, eight, and two sevens	12
Six (or nine), seven, and two eights	12
Two fives and two tens (or court cards of like denomination)	12
Two nines and two sixes	12
Ten, court card, and two fives	10
Seven, eight, and two sixes	10
Five and three court cards (or a ten and two court cards) in sequence	9
Any sequence of three cards, with a duplicate of one of them	8

To the above must be added the value of the *flush*, where such occurs, or the *nob*, where the knave of same suit as the turn-up chances to form part of the hand.*

* The crib, including the turn-up, will consist of *five* cards. For the scores that can be made by this number of cards, see the six-card game.

SIX-CARD CRIBBAGE.

Six cards are dealt to each player. The non-dealer does not at this game take three points at starting, and the unplayed cards are not thrown down so soon as thirty-one (or the nearest point to it) is reached, but are played out to the end, the player who failed to score the "go" being the next to lead.

There is, however, a marked difference in the number of points scored, the addition of an extra card causing an enormous increase in this particular. The following are some of the leading scores which can be made with five cards.

	Points.
Four fives and a ten or court card *	28
Two fives, two fours, and a six	24
Two fives, two sixes, and a four	24
Two fours, two sixes, and a five	24
Two sevens, two eights, and a nine	24
Four threes and a nine	24
Three fives, a four, and a six	23
Three fours, a five, and a six	21
Three sixes, a four, and a five	21
Three sevens, an eight, and a nine	21
Three eights, a seven, and a nine	21
Four twos and a nine	20
Four threes and a six	20
Two sixes, two sevens, and an eight	20
Two sevens, two nines, and an eight	20
Two eights, two nines, and a seven	20
Three tens (or court cards of like denomination) and two fives	20
Three threes and two nines	20
Three sevens and two aces	20
Three threes and two sixes	18
Three fours, five, and three	17
Three tenth cards (in sequence) and two fives	17
Any three cards in sequence, with duplicates of two of them, but no "fifteen"	16
Any three cards in sequence, one thrice repeated, but no "fifteen"	15

It is usual to make "game" in six-card cribbage *twice* up and down the board: viz., one hundred and twenty-one instead of sixty-one.

SEVEN-CARD CRIBBAGE.

This is played exactly as the six-card game, but as *five* cards remain in the hand of each player (making with the start *six*), the scores run to still higher figures, and in order to counterbalance this, *game* is made three times up and down the board—one hundred and eighty-one points.

THREE-HANDED CRIBBAGE.

Where three play, five cards are dealt to each, with an extra card in the centre to form the foundation of crib, to which each contributes one card only. The player to the left of the dealer leads and has first show, and the deal afterwards proceeds in rotation from right to left. The score is in this case usually marked on a triangular board, one side for the pegs of each player.

* As these very high scores may somewhat puzzle the young player, it may be well to explain how a few of them are made up. In the case of four fives and a ten, the four fives, in groups of three, score fifteen-eight, and fifteen-two each in combination with the ten, making fifteen-eight more. The four fives, as a double pair royal, score twelve: total, twenty-eight. The next four combinations each score as fifteen-eight, with two pairs, and a run of three *four* times repeated = twenty-four. Four threes and a nine (fifteen-twelve and a double pair royal) also = twenty-four. Three fives, four, and six make fifteen-eight, a pair royal, and run of three thrice repeated = twenty-three.

FOUR-HANDED CRIBBAGE.

Where four persons take part, they play two against two, partners facing each other, as at whist. Five cards are dealt to each player, and one thrown out by each for crib. Consultation is not allowed during the play of the hand, but partners may assist each other in counting their respective hands.

The cards are played right out (not stopping at thirty-one), as in the six-card two-handed game. The score is usually one hundred and twenty-one points.

LOO.

LOO is played after two different fashions, known as "three-card" and "five-card" respectively. Both are played with the full pack of fifty-two cards, and any number may play. The cards rank as at whist, from ace (highest) down to the two.

THREE-CARD LOO.

The dealer having been chosen, pays an agreed number of counters (either three or some multiple of three)*, to start the pool. He then deals one by one three cards to each player, with an extra hand, also of three cards, known as "miss." The card next following on the pack is turned up to decide the trump suit.

The dealer then inquires of each player in rotation, beginning with the player on his left, whether he will "take miss." If the player has a good hand, he will play his own cards; if not, he may "take miss": i.e., receive the extra hand in place of his own. Or, if he prefer it, he may "pass": i.e., throw up his hand altogether, with all chance of winning or losing for that round. If "miss" be declined by the first player, it is offered to the second, and so on. No one is permitted to look at the three cards discarded.

Should one player have taken "miss," and the rest "pass," such player takes the pool. Should all but one have passed, and "miss" not be taken, the dealer may, of course, either play his own hand, or take "miss" on his own account. If disinclined to do either, he must take "miss" and play it for the benefit of the pool, his winnings, if any, remaining therein, to abide the result of the next round.

When all have decided whether to play or pass, the elder hand proceeds to lead, but in so doing he is bound by the rules following:—

1. If he has two trumps, he is bound to lead one of them.
2. If he has the ace of trumps (or king, ace being turned up), he is bound to lead it.
3. If there are only two standing players, and he holds two trumps, he must lead the highest, unless his trumps are in sequence, when he may lead either.

The other players play to the trick in rotation, but they also must do so in accordance with certain rules:—

1. Each player must follow suit, if he can.
2. He must "head the trick" (see Technical Terms), if he can.
3. If unable to follow suit, he must trump the trick, if he can. If it is already trumped, he is bound to play a higher trump, if he has one.

The winner of one trick leads to the next. He is subject to the same rules as the original leader, and is further bound, if he can, to lead a trump.

* There being *three* tricks, it is necessary that the pool should be divisible by that number.

At the close of the hand the pool is divided, one-third to the winner of each trick. Each who has played, but not won a trick, is "loosed"—i.e., fined the like number of counters as was originally placed in the pool.* This fine is known as a "loo," and the aggregate of loos, with a contribution from the new dealer, forms the pool for the next round.

It may chance that only three players declare to play, and that each takes one trick. In such case no one is loosed, and the pool for the next round consists solely of the amount placed therein by the dealer. When this occurs, the next round is made a "force," or "must," signifying that every one, whatever his cards, *must* play. In such cases there is no miss, and as all but three players must of necessity be loosed, a full pool is ensured for the next hand.

FIVE-CARD LOO.

In this case *five* cards are dealt to each player, the card following being turned up for trump. There is no "miss." Each player has the option to "play" or "pass." If he elects to do the former, he is entitled to discard any portion of his hand, receiving in exchange a like number of fresh cards from the stock.

The rules as to leading, heading the trick, etc., are the same as in the three-card game, but the knave of clubs, known at this game as "Pam," is made a sort of extra trump. This card even takes precedence of the ace of trumps; but there is a curious rule, that if a player leading the ace of trumps at the same time pronounces the formula, "Pam, be civil," the holder of Pam is bound to let the ace win the trick, if he can do so without making a revoke.

The holder of a "*flush*" (i.e., five cards of one suit, or four of one suit and Pam, which for this purpose is regarded as of any suit the holder pleases) on showing it becomes entitled to the pool, every other player being loosed. A player who, by this or any other means, wins the whole five tricks is said to "loo the board."

As between two flushes, should such occur, a flush in trumps is preferred to one in a plain suit. (See Technical Terms.) As between rival flushes in plain suits, the cards showing the higher total win. The holder of the losing flush, or of Pam, if in the hand of one of the players, is exempt from the payment of the "loo."

Sometimes at either form of the game (three-card or five-card) the players agree to be subject to "club law." This means that whenever a club is turned up by way of trump, the hand shall be a "must," all being bound to play. There is in this case no drawing of cards, and "miss" (at three-card loo) cannot be taken.

NAPOLEON, OR "NAP."

THIS game is played with the full pack of fifty-two cards, which rank as at whist. The number of players is nominally unlimited, but should not be less than three or more than six. Napoleon may be played with or without a pool (in this case known as a Kitty). We shall in the first place describe it without this addition.

The dealer having been chosen, deals round (either one by one, or by twos the first round and threes the second, or *vice versa*) five cards to each player. Each looks at his cards, and considers how many tricks—if he were allowed to

* Or, by agreement, any other number, provided that it be divisible by three.

*name the trump suit, and having due regard to the number of cards that are distributed**—he might fairly expect to make.

Each player now declares in rotation (beginning with the elder hand) how many he will "go," i.e., how many tricks he will undertake to win. Each must name a higher number than any previously named, or say "Pass," meaning not that he retires from the game, but that he does not feel safe in challenging the rest of the table. Thus, we will suppose, with five playing, that A (elder hand) says, "I go two." The next player, B, not feeling safe in declaring to win a higher number, says, "Pass." His successor, C, says, "I go three," D and E "pass." C then has the lead, and *the card he first leads determines the trump suit*, giving him in effect the naming of the suit. The other players play in succession to the card led, the highest card winning the trick. The winner of one trick leads to the next. The challenging player (known as the "stand" hand) does his best to win the number of tricks he has declared, the other players doing their best to prevent his doing so, but being quite indifferent, as between themselves, who may win a given trick, so long as C does not. Thus if D have played a higher card on C's, the remaining players studiously play their lowest, reserving their better cards for use at a later period of the hand.

Should C succeed in winning the three tricks which he declared, each of the other players pays him three counters. Should he fail, he pays to each of the other players a like number: i.e., one for each trick he declared.

A player who thinks he can make all five tricks announces this fact by saying, "I go Nap," or simply "Nap!" Should he fail, he must pay five counters to each of his adversaries. Should he succeed, he will receive double: i.e., ten counters from each.

A declaration of "Nap" made in due turn by any one player bars any further declaration.†

There is another "call," known as *Misère*, meaning that the player undertakes *not to win a single trick*. *Misère* takes precedence of a call of two, but is superseded by a call of three. If the caller of *Misère* fulfils his undertaking, he receives three counters from each of his antagonists. If he wins even a single trick, he is bound to pay three counters to each.

The laws of Nap are few and simple. There is no penalty for a misdeal, the deal being no advantage. If the dealer exposes a card, or gives a player too few or too many cards, the cards are re-shuffled and cut, and he deals again. Any one playing out of turn, unless to a trick already won, pays the value of three tricks to the stand hand, and cannot win anything that round. If the stand hand plays with a wrong number of cards and loses, he pays; if he wins he receives nothing. A player making a revoke pays the value of five tricks to the stand hand, and can win nothing that round. The stand hand revoking pays the value of five tricks to each player.

How to Play.

The strength of a hand at Nap depends mainly upon the number of cards in the player's longest suit, which he should, as a matter of course, make trumps. A

* Thus, if five are playing, twenty-five cards only are distributed. In such a case a king may probably be the best card, for it is more than an even chance that the adverse ace is in the stock. With four players, only twenty cards are dealt, and the chances of a given card being in the stock are rather more than five to three.

Further, if a player (being one of five) holds three cards of a given suit, he may fairly assume that half of the remaining ten are in the stock, and that consequently there are but five among the four other players. If four only are playing, and he holds three cards of a suit, he may in like manner reckon that of the remaining ten six are in the stock, and four only divided among the other players.

† Some players allow a call of "Wellington" (meaning that the player undertakes to win all five tricks, and forfeits double if he loses) to over-ride that of "Nap." The variation is not, however, to be commended.

simple illustration will prove this. A player holds (say) ace and king of spades, and ace of each of the three other suits—a promising hand, and one on which the most timid player would “go Nap;” but against five spades, however small, it will only make two tricks. Again, take a hand consisting of the ace and king of hearts and three small clubs. If the player were so ill-advised as to make hearts trumps, the chances would be much against his making more than two tricks. If, on the contrary, he leads a club, so making clubs trumps, he has every prospect of making at least three. The first thing, therefore, to be remembered by the young Nap player is therefore—*Always make your longest suit trumps.*

Further, as a general rule, the best card of such a suit should be played. If you hold ace or king, you should certainly play it. With queen or knave, and two or more small cards, some players prefer to lead a small card. If the card led wins, and you have two or more of the trump suit, it is generally best to continue it. If you had only two at the outset, and your remaining trump is not a certain winner, it is safest to play your best plain suit card.

With regard to the play of the non-standing hands, their general course is simple enough: viz., to win the trick if they can as against the stand hand, and if they cannot, or if it be already won, to play the smallest card possible. It is very rarely good play to pass a trick at Napoleon on the chance of its being headed by some later player.

In the case of *Misère* the ordinary rules of play are reversed. The lead must be from a single card, which should not be higher than a seven; and whenever there is an opportunity of a discard, the highest available card should be played. It follows that the only safe hand for a *Misère* is one which contains a low single card of some one suit, and no high card, unless guarded by a small card of the same suit. The non-standing players will as a rule play their lowest cards, in the hope of forcing the stand hand to win the trick. If, on the other hand, a non-standing player be forced to win a trick, he should do so with the highest card possible, and in like manner, whenever he has an opportunity for a discard, he should avail himself of it to get rid either of a trump* or of a high card.

As we have already stated, Nap is sometimes played with a pool, or “Kitty.” The pool is started at the outset by an agreed contribution, generally the value of one trick, from each player, the dealer paying double, and increased by a like contribution from each new dealer. Should a player make “Nap,” he takes the contents of the pool, in addition to the counters paid to him by the other players. The pool is then started anew as at first.

Ecarté or *Purchase Nap* only differs from the ordinary pool game in the fact that a player dissatisfied with his cards may discard any number of them, and receive a like number from the pack, paying to the pool an agreed amount: say one counter for each card exchanged. This done, the players make their declarations in due order. The play is the same as in the ordinary game, but a hand which would have a good chance of making three tricks at the ordinary game will not be good for more than two at Purchase Nap.

POPE JOAN.

THE game of Pope Joan requires a special board, of which a bird's-eye view is given in the annexed illustration. It consists of a circular bowl or tray revolving

* Some players ignore trumps upon a declaration of *Misère*, all suits being regarded as plain suits. There should be an understanding beforehand whether this rule is to prevail.

on a central pillar, and divided by radial partitions into eight compartments, each capable of containing some ten or twelve dozen counters. These divisions are respectively appropriated to *Pope* (the nine of diamonds), *King*, *Matrimony*, *Queen*, *Intrigue*, *Knave*, *Ace*, and *Game*, as indicated by appropriate words or figures set against each compartment. *Matrimony* signifies the conjunction in the same hand of the king and queen of trumps; *Intrigue*, that of knave and queen.

Any number may play. Each player is beforehand provided with an agreed-on number (say, three or four dozen) of counters. The dealer having been selected, his first duty is to "dress the board": i.e., to place in the different

compartments fifteen counters from his own store; six being allotted to *Pope*, two to *Matrimony*, two to *Intrigue*, and one to each of the other divisions.*

The pack used is the ordinary whist pack, lacking the eight of diamonds which is removed from it and laid aside. The cards are dealt one by one to each player in succession, with an extra hand in the centre of the table. The last card is turned up by way of trump. Should the turn-up chance to be an ace, king, queen, knave, or *Pope*, the dealer takes the counters in the corresponding compartment of the board.†

The elder hand (see *Technical Terms*) then leads any card he pleases, at the same time naming it aloud. The person who holds the card next in ascending sequence plays and names it, then the holder of the next card, and so on, till no one can play a higher card, when the person who last played leads afresh.

At first sight, it might be imagined that as all the cards have been distributed, the play would continue until the king of the suit was reached; but such is not always the case. It will be remembered that an extra hand is dealt. The object of so doing is to create "stops": i.e., cards which cannot be followed by the next in sequence. Thus kings are naturally stops (the ace being at *Pope* Joan the lowest card); the seven of diamonds is also a stop, because the eight has been removed from the pack. Further, each card in the extra hand makes the one preceding it a "stop." Thus, if the knave of clubs and nine of spades be among the extra cards, the ten of clubs and eight of spades are "stops." Again,

* Some boards have five compartments only, those for king, queen, and knave being omitted. In this case twelve counters only are used.

† As the game is sometimes played, if the dealer turns up *Pope*, he takes in addition the counters in the "game" compartment, and each player pays him an agreed-upon stake, the hand not being played. This method, however, is not recommended.

if a given card be led, it makes the one preceding thenceforth a stop, and the breaks in play are therefore very frequent. When a stop is reached, the cards previously played are turned face downwards, and the owner of the "stop" proceeds to lead any card he pleases.

The main object of each player is to get rid of all his cards, for the one who is first "out" is the winner of the round, and receives not only the counter in the game compartment, but one counter from each player for every card remaining in his hand. The holder of Pope, if he retains the card in his hand, is exempt from payment. If he has played it he pays like the rest.

If in course of the round any player plays the king, queen, knave, or ace of the trump suit, or Pope, he takes the counters in the corresponding compartment. If any player plays both king and queen of trumps, he is entitled to the counters in the *Matrimony* compartment, or if he plays knave and queen, to those in *Intrigue*, but this only happens where both cards fall from the same hand.*

Hints for Play.

A sequence forms a good lead, inasmuch as it enables the player to get rid of two or three cards at once. Cards in alternate sequence, as seven, nine, knave, are also good, for if one of the series proves to be a stop, the leader goes on again. If some one else plays the card next in sequence, the leader follows it with the next but one. An alternate sequence, headed by king or some other known stop, is the best of leads, inasmuch as (unless some other player runs out first) it of necessity keeps the lead in the hand of the possessor.

Each player should carefully watch the course of the game, and note whether any of his cards become stops from the fact of the card next following having been led. There is, however, another consideration that must not be lost sight of. There are certain cards that *cannot be led to*, and which, therefore, the player should take an early opportunity of getting rid of. Aces are in this position, from the fact of there being no lower card. Pope cannot be led to, the eight of diamonds being removed from the pack expressly to produce this result. Further, if a card—say, the five of spades—is declared a stop by reason that the six is among the extra hand, it is clear that the next higher, the seven, cannot be led to; and the possessor of the seven should take mental note of this fact, and get rid of the card at the earliest convenient opportunity. It is not, however, always wise to make such a card a first lead. If the player has a number of certain stops, or a series terminating with a stop, these should be first led, and then the card in question. Where, however, this card forms part of a broken series terminating in a stop, it should be led in preference. As, for instance, where the player holds ace, four, five, and seven of diamonds (the seven being a known stop), the ace should be led, for unless the two or three chances to be among the extra hand, the player is safe to run on to the seven.†

The dealer is sometimes allowed the privilege of looking at the extra hand; professedly, in order that he may declare whether a given card played is a stop or not. This gives him, however, a material advantage in the play of his own hand, and it is much better not to allow it. If no one plays within a reasonable time to a given card, it should be taken for granted that it is a stop, and another at once led by the last player. Should it be afterwards discovered that the card next in succession is in the hand of some other player, such player is justly punished for his or her lack of attention to the game.

* As the game is sometimes played, if the appropriate cards fall from different hands the holders are allowed to *divide* the contents of the *Matrimony* and *Intrigue* compartments, but this *during the game* is an irregularity. In the final round it is allowable.

† For further hints as to play, see the remarks of "Cavendish" in relation to the game of *Snip Snap Snorum*, quoted at page 870.

If, as usually happens, there are counters left at the close of the game in one or more divisions of the board, the cards are dealt round face upwards, and the possessors of Ace, King, Queen, and Knave of *diamonds*, and of Pope, take the counters in the corresponding divisions. The counters in *Matrimony* (if any) are divided between the holders of the king and queen of diamonds, and those in *Intrigue* between the holders of queen and knave. The *Game* compartment, being cleared at the close of each round, is necessarily empty.

SPINADO.

THIS is a modernised version of Pope Joan. As at that game, any number may play. The full pack is used, less the four twos and the eight of diamonds, which are removed, making the four aces and the seven of diamonds "stops," and preventing the four threes or the nine of diamonds being led to.

No special board is used, but the pool is divided into three parts: *Matrimony*, *Intrigue*, and *First-out*; the last division answering to "Game" at Pope Joan. The dealer places twelve counters in the *Matrimony* division, and six in each of the two others, while *First-out* receives, in addition, a contribution of three from each player. King and queen of diamonds falling from the hand of the same player constitute *Matrimony*, and queen and knave of diamonds *Intrigue*. The cards are dealt round with an extra hand, as at Pope Joan, the cards preceding those of such extra hand thereby becoming stops.

The ace of diamonds is known as Spinado, or, more shortly, "Spin." It may be played with any other card, and has the peculiar quality of making such a card a stop. Thus, if the eight of spades be led, the holder of Spinado may say "Nine, and Spin," playing those cards accordingly. He is entitled in respect of Spin to receive an immediate payment of three counters from each player, and to lead again, notwithstanding that some other player may hold the ten of spades. The holder of Spin is, however, not compelled to play it with his first card, and it is often good policy not to do so, as, for instance, where such first card is of right a stop, say a king or the seven of diamonds. Suppose, again, that he held the five and the seven of diamonds and that the four was led. In such case he would hold back Spin until after playing the seven of diamonds (stop) and play it with his third card, selecting as such third card one which would not otherwise be a stop, as the playing of Spin with it will make it so.

Any one playing knave and queen of diamonds is entitled to the counters in the *Intrigue* division of the pool; any one playing queen and king, to those in the *Matrimony* division. A player playing a king, of whatever suit, is entitled to one counter from each of the other players.

In other respects the game proceeds as at Pope Joan, the player who first gets rid of all his cards being the winner, and taking not only the *First-out* pool, but a counter for each card left in hand from each of the other players. The winner is exempt from contributing to *First-out* for the next round.

The holder of "Spin" unplayed pays to the winner double (two counters) for each card he holds.

OLD MAID.

FROM a full pack of fifty-two cards take out one queen.* Shuffle well the remainder, and deal them, face downwards, equally to all the players until the pack is exhausted.

Each player then looks at his cards, and if any of them prove to be a pair—as two kings, two tens, or two sevens—he throws them in the centre of the table. Each then arranges his remaining cards in a fan-shape, to be held in the hand, and the honour of every one is depended upon not to look at any cards but his own, fair play in this particular being the essence of the game.

The player on the left of the dealer now offers his cards, face downwards, to his left-hand neighbour, to draw from them any card he likes. The drawer, looking at the card he has taken, tries to match it with one of those in his hand. If able to do so, he throws the pair out into the middle of the table; if not, he places it among his own, and offers his cards to his left-hand neighbour, that he also may draw any card he likes. Thus the game goes on until all the cards are paired, excepting, of course, one card: the companion to the banished queen. The holder wins the game, but is surely destined to be an old maid or an old bachelor.

SPECULATION.

SPECULATION may be played by any number of persons. Each contributes an agreed-upon number of counters (say, three) to form a pool. The dealer pays double.

The full pack of cards is used. The dealer having been chosen and the pool formed, three cards are dealt *face downwards* to each player, that next following being turned up by way of trump. This card belongs to the dealer, in addition to the three in his hand.

The object of the game is to hold the *best trump* among the cards dealt, the player holding such card at the close of the round being entitled to the pool. Should the turn-up card be an ace (the best possible card), the pool belongs to the dealer. If the turn-up is not an ace, but a pretty good card—say, a ten—it may still have a fair chance of winning the pool, and therefore becomes an object of "speculation": i.e., some player may think it worth while to purchase it, the price being a matter of agreement between himself and the dealer. We will suppose, however, that the dealer retains the card. The game commences by each player in rotation (beginning with the elder hand, or player to the dealer's left) turning up his uppermost card. Presently some one turns up a better trump than the one already exposed (say, the knave), when the ten becomes valueless, and the new card becomes an object of competition. The holder of the winning card for the time being is exempt from turning up any other of his cards, and this gives it an additional value. When all the cards dealt

* Some players prefer to take out a card haphazard. This card is put aside, no one being allowed to look at it, and the last left in hand of the three corresponding cards will become the Old Maid card. Thus, if the card removed be the nine of diamonds, one or other of the remaining nines (according to which two of them are first paired) will be *Old Maid*.

The advantage claimed for this method is that no one knows till the last moment what card may be "Old Maid," and consequently, whether he or she has it or not.

A round of Old Maid is sometimes used at the close of a round game (Nap, for instance), where the pool has not been cleared, to decide who shall be entitled to it, the holder of Old Maid being the winner. In this case, the method last described is clearly preferable.

have been duly turned up, if no better card than the knave has appeared, the owner of that card takes the pool. The appearance of the ace of trumps at any stage decides the round in favour of the possessor.

It is not alone the leading card for the time being which may be an object of speculation. A single card or a hand of cards not yet turned up may be sold in like manner, though, their value being problematical, they naturally fetch a much lower price than a card which is a probable winner.

The fairness of the game depends upon the cards not as yet shown remaining absolutely unknown to the holders, and it is therefore customary to make any one prematurely "peeping," either from carelessness or intention, pay an agreed-on fine (say, six counters) to the pool. The card or cards looked at should be thrown face upwards in the centre of the table, and regarded as if they had formed part of the undealt portion of the pack.

Some players make it a rule that any one turning up a *five* or *knave* of any other than the trump suit shall pay an agreed-on fine (say, three counters) to the pool. The infliction of this small penalty adds to the fun of the game, particularly where, as often happens, it occurs in reference to an unknown card which the holder has just purchased from some other player.

Another variation consists in dealing at each round an extra hand of three cards in the centre of the table. When the round is at an end, this extra hand is turned up, and if it contains a better trump than the apparent winner (as, for example, if the latter is a queen, and a king is found in the extra hand), the pool is left to abide the result of the next round. Each player again contributes; so that the pool becomes of double value.

RANTER GO ROUND.

RANTER GO ROUND is a favourite game in Cornwall. It is little played elsewhere, but deserves to be more widely known, for few round games surpass it in animation.

First of all, each player is provided with three counters, or "lives," as they are called, and the object of the game is to see which player will succeed in keeping his lives the longest.

An ordinary pack of fifty-two cards is shuffled, and a single card is dealt, face downwards, to each player.

The players look at their cards, and the one on the left of the dealer, if his card is lower than he likes, has the option of changing with his left-hand neighbour, who again may change with his left-hand neighbour, and so on till the low card reaches the dealer. As he has no one with whom to exchange, he is allowed to cut, and take in place of it a card from the middle of the pack. The players then turn their cards face upwards on the table, and the possessor of the lowest card (aces being counted lowest) has to forfeit one of his lives.

The game thus goes on until all the players are out but one, who is the winner.

If a player chance to give in exchange to his right-hand neighbour a card lower than the one he receives, he *stands*, or, in other words, does not claim to change with his left-hand neighbour, knowing that he is safe for that round; for at any rate one card lower than his own is out. If two players have cards of the same value, and these cards are lowest, the younger hand—i.e., the player who last received his card from the dealer—loses a life.

No player may exchange more than once. A player holding a king may decline to exchange, and as a matter of course does so, simply saying, "king." Hence probably arises another rule, which at first sight seems rather contradictory: namely, that should the dealer, taking a card in exchange from the pack, turn up a *king*, he is the victim for that round.

Sometimes a rule is enforced that whenever a player exchanging with his left-hand neighbour gets a card with *one, two, or three* pips given him for his own, the player with whom he exchanged cries out the value of such card, that the other players may know its worth.

At the close of each round the loser places one of his "lives" in the pool. A player who has lost all his lives may purchase an extra one from a more fortunate player who is disposed to sell, but no player can purchase while he still has a life in hand.

VINGT-UN.

ANY number of persons may join in this game, about six being the best number. Each player is supplied with an agreed-upon number of counters (say three dozen) to represent the stakes. The full pack of fifty-two cards is used.

An ace may either be reckoned as *one* or as *eleven*, to suit the convenience of the holder. Court cards count as ten each; all other cards according to the number of their pips. The cards having been duly shuffled and cut, the dealer gives one card, face downwards, to each player, including himself. The players, looking at the cards, each place in front of them a stake, consisting of one or more counters, up to a fixed limit (say, six).

Beginning with the elder hand (see Technical Terms), a second card is then distributed to each. Should the dealer at this stage find that his two cards are an ace and a ten or court card (counting twenty-one, and constituting a "natural"), he turns them up, and each player (unless chancing likewise to hold a natural) pays him double the amount of his stake. Should the dealer not hold a natural, he offers each player in turn the option of taking one or more additional cards. This he does either by asking "Do you stand?" (meaning, "Are you content without any additional card?") or "Will you take a card?"

The answer to this question will depend upon the cards already held by the players. The object of each player is to make twenty-one, or as near thereto as possible, but if this amount be exceeded the player loses his stake. The young player will find it a good rule always to "stand" (i.e., be content without another card) if his two cards amount to sixteen or more; with any less number he should, as a rule, take a card, and if he is still short of sixteen, another. These supplementary cards are dealt face upwards. Should the card or cards thus taken make the player "over" (i.e., above twenty-one), he throws up his cards and hands his stake to the dealer, and has no further interest in the game for that round. If the player does not wish for a card, he says "I stand," or "Content," and the dealer passes to the next player. All the players having either declined the offer of additional cards, or having received as many as they wish, the dealer turns up his two cards, and either *stands* with them as they are, or draws as many supplementary cards as he pleases. If he should go "over," he pays all the standing players the amount of the stakes they made, and to those who have cards making exactly twenty-one, whatever they may be, he pays double the amount of their stakes.

We will suppose, however, that the dealer does not go over, but "stands" at,

say, eighteen. He turns up his cards, and the other standing players do likewise. All who are nearer twenty-one than himself he pays; to each the amount of his stake. Those who have the same or a less number, pay him.

Should any player have a natural (*i.e.*, twenty-one made by two cards only), he does not wait for the conclusion of the round, but turns up his cards, and is entitled to receive from the dealer (unless he, too, has a natural) double the amount of his stake. Even though the dealer may by drawing cards make twenty-one, the holder of a natural still receives his double stake.

The turning up of a natural (otherwise than by the dealer himself, or in the first round of a deal) terminates the deal, which in some circles passes to the holder of the natural, in others, to the player seated to the left of the dealer. The latter is the fairer plan, as it gives each player the advantage of the deal in turn.*

Supposing any player's first and second cards should be alike, he may divide them and place a like stake on each, regarding each as a separate hand, and drawing cards accordingly, in the hope of making *two* twenty-ones instead of one. The third and fourth cards are dealt face downwards (the third on the first, the fourth on the second), but all cards afterwards drawn are dealt face upwards. The first hand must be completed before drawing to the other.

At the beginning of a game a player is at liberty to sell his deal if he should desire to do so.

The dealer may, before receiving his second card, declare a *double*, thereby multiplying by two the stakes made by the players. The double stake is not shown on the table, but the players pay or receive accordingly. A prudent dealer only doubles when his first card is an exceptionally good one (say, an ace, ten, or court card), or when the stakes of the other players show by their smallness that they have received unfavourable cards. Many dealers make a practice of doubling with eight or nine, on the chance of receiving a tenth card.

Another privilege sometimes permitted to the dealer is what is termed the *brûlet*, which consists of the top and bottom cards of the pack, after it has been shuffled and cut. Before beginning to deal, the dealer may look at these two cards, and should they united constitute a natural, every player must pay him double stakes. The cards are then re-cut, and the proper deal is made. The allowance of the *brûlet* is, however, by no means universal, and it should therefore be decided beforehand whether it is to be recognised.

On an eight, nine, ten, court card, or ace, the player will do well to put the *maximum* stake, as from the large number of tenth cards in the pack, there is every chance that the second card may give him a good point. Seven is a doubtful card. On two to six inclusive, it is well to stake only the *minimum*.

FRENCH VINGT-UN, OR ALBERT SMITH.

THIS is a variation of the ordinary game of *Vingt-un*. It is desirable to limit the number of counters staked, say, to a *maximum* of half-a-dozen, the dealer having the privilege of "doubling" should he be so inclined.

The eight rounds of which the game consists are all played differently; the first exactly resembles ordinary *Vingt-un*.

* Such advantage is twofold: for, first, "ties" pay the dealer; and secondly, he receives from every player who goes "over," notwithstanding that he may ultimately do the same himself.

The second round is called *Imaginary Tens*, and also resembles *Vingt-un*, excepting that each player, whatever cards are dealt to him, counts them as ten more than they really are. As in *Vingt-un*, one card is given to each, but in this case he must make his stake before receiving it. To this card the imaginary ten is added, and then the players either take more cards or stand, in order as near as possible to make twenty-one.

The third round, *Blind Vingt-un*, comes next. Here each player, after making his stake, has two cards dealt to him. He may either stand on these two cards, or draw more, but whatever decision he makes, it must be arrived at without looking at his cards (hence the name).

In the fourth round, which is known as *Sympathy* or *Antipathy*, every one makes his stake, and announces which of the two he backs, *Sympathy* or *Antipathy*, the former being expressed by two cards of the same colour, the latter by two cards different in colour. He then receives from the dealer two cards, which, if corresponding with his choice, make him a winner; if the contrary, he must pay the dealer.

The fifth round, *Rouge et Noir*, closely resembles the preceding round, excepting that, instead of two cards, one card only is given to each player, whose stake has reference to nothing more than the colour of the card. In some circles three cards instead of one are dealt. When this plan is adopted the colour is decided by two out of three.

In the sixth round, called *Self and Company*, two cards are put down by the dealer, one of which he names *self*, and the other *company*. A stake consisting of a certain number of counters is placed upon the table by each player, and if the two cards that have been dealt prove when turned up to be alike, the dealer wins. If otherwise, he must go on dealing until a card is turned up that pairs with either *self* or *company*, the card thus paired being the winner, and the dealer receiving or paying, as the case may be.

In the seventh round, known as *Differences*, or *Pips*, there is no staking whatever. The dealer simply gives two cards to each player, including himself. He then compares his own with those of each of the company, and everyone whose cards are less in value than the dealer's gives him as many counters as represent the difference, one for each pip, while, on the other hand, the dealer has to pay in the same way those whose cards are higher than his. Ties cancel each other, and the ace reckons as *one* (not *eleven*); court cards as ten.

The last and eighth round is called the *Clock*. A certain stake being agreed upon, each player lays his counters in front of him. The dealer then begins to turn up cards one by one, at the same time counting up to thirteen, or rather up to ten, after which he says "knave, queen, king." During the counting, should he happen to turn up a card corresponding with the number he is at the time calling out, he wins all the stakes, but if he counts as far as king (that is, thirteen), and every card has been different to the number called, he pays each player the amount staked.

When the eight rounds are completed, the deal passes to the left of the last dealer.

SNIP-SNAP-SNORUM.

THE point aimed at in this game by each player is to be the first to get rid of his cards, as the one who is first out is the winner, and can claim from each of the other players as many counters as they have cards left in their hands.

Any number may play, about six or seven making the best game.

First of all, a whole pack of fifty-two cards is dealt out, one by one, to the players, the first of whom, after the hands have been examined, begins by putting down any card he likes, at the same time calling out *Snip*.

Any one holding the next higher card of the same suit places it upon the table before him and cries *Snap*; while the person possessing the next higher to this calls out, as he plays it, *Snorum*.

The person holding the next card cries *Hi-Cockalorum*; and should a still higher card be out, the possessor plays it, and cries *Jig*.

The last word signifies a *stop*; therefore no one can continue the sequence. The play, however, may be cut short at an earlier period: as, for instance, if a knave be led, the sequence will in this case consist of three cards only, for king, as highest card, is necessarily a stop. In this case the player of the king would cry *Snorum-Jig*, the word *Jig* being affixed whenever the card played, whatever its number in the sequence, is likewise a stop. The leading of any given card, naturally makes the one which precedes it a stop.

The ace counts as one (the lowest card), and therefore cannot be led to.

The player who first succeeds in getting "out" receives in some instances not only the separate contribution of each player, but also the contents of a pool, formed by a fixed donation from all the players. The excitement of the game may be heightened by the infliction of fines (one to three counters, as may be agreed) for any irregularity, such as leading or playing out of turn, playing a wrong card, or exposing a card. All such fines to go to the pool.

It is desirable that the player should keep the lead as long as possible in his own hand, and in order to do so he must not play his cards at random, but must use discretion and forethought. "Cavendish" advises as follows, and his advice cannot be improved upon:—"There is a good deal of play in choosing the best card for a lead. Cards should, if possible, be chosen that will bring the leader in again. Thus, holding five, six, seven, nine, and knave of a suit, lead the seven. The knave is a *jig* to the seven,* and will keep the lead. The six, now being a stop, should be played out, and the five reserved (as a rule) to procure the lead again, when a small card of that suit is led by some one else. Aces and cards that cannot be led to should be got rid of as soon as the lead can no longer be kept. Kings and cards that have become stops in the course of play should not be parted with early in the hand, as they are useful in re-procuring the lead; but when the leader has all stops except one card, he should lead them one after the other, and then the last card, and say "Snip-Out." When unable to keep the lead, it is, as a rule, best to lead so as to get rid of the largest number of cards, except in the case of sequences, when generally the *lowest but one* of the sequence should be led, to make the lowest a stop."

The above is the most common manner of playing this game. Another method is as follows:—

Every one places before him five counters, which are considered as stock.

The aim of each is in this case to play a card of equal value with that of the first player, which is called *snipping*. The third player, having a card of like value, *snaps*; and the fourth player, being equally fortunate, *snorums*. Each can, however, only play in his turn. Thus, if the second player cannot pair the first, it is of no avail that the third player is in a position to do so. In such case the leader plays again, and so on wherever there is a break in the chain, the player of the last card being the new leader.

* As being the highest of the sequence of five cards from the seven. The eight and ten will be played by other persons, but the leader will follow with his nine and knave.

By way of illustration, we will imagine the elder hand to have played a queen. The second player also plays a queen, in consequence of which the first player is *snipped*, and has to place a counter in the pool. The third player then also plays a queen, when his predecessor (the second player) is *snapped*, and must put two counters in the pool. If the fourth player also has a queen, the third player is *snorumed*, and pays three counters.

As each player becomes bankrupt by having had to pay all his counters, he goes out of the game, the pool falling to the lot of the player whose stock holds out the longest.

Every one is bound to snip or snap if he can possibly do so, subject of course to its being his turn to play.

SNAP.

THIS is another very lively game, but by no means to be confounded, from the similarity of its title, with *Snip-Snap-Snorum*. It may be played either with the ordinary whist cards, or with a special pack manufactured for the purpose. The designs of these are usually of a comical character.

Each pack consists of about fifty cards, on four, five, or six of which are represented the same object. A similar number of cards depict another object; a similar number again another object, and so on with the whole pack. Thus, on four cards may be a rose, on other four a lily, on other four a geranium, on four more a pansy, and on the rest of the cards other flowers.

The whole pack is dealt round, face downwards, to any number of players. No one must look at his cards. The first player begins by turning up the top card of his pile, and placing it at a little distance in front of him. The next does the same, and so on, but as soon as any one turns up a card resembling one that has been already exposed, he calls *Snap*, thereby winning all the cards that have been turned up by the owner of the card resembling his own. If, however, the owner of that card calls *Snap* first, the tables are turned, the first *Snapper* becoming possessor of the other's cards.

The utmost vigilance is required to play the game successfully, for, as will very soon be discovered, those who do not call *Snap* frequently will very soon be "out," and will only be able to sit by as spectators. The quickest of players will, however, in course of time be obliged to retire from the scene of action; one by one they will find themselves destitute of cards, until at last the contest remains to be fought out by two players only, the one finally left with the cards in his hand being the winner.

Where the game is played with the ordinary pack the "snapping" is between the cards of like value, as the aces, the twos, and so on.

SPADE THE GARDENER.

THE chief requirement for this game is a good memory, combined with a little tact to note and seize any useful indications which may be derived from the manner of the players. It is played with the aces, court cards, and tens of an

ordinary pack, each card, for the nonce, being distinguished by a special name. Thus:—

*The King of Spades is known as Spade the Gardener.
The King of Hearts as The Good-natured Man.
The King of Clubs as Club the Constable.
And the King of Diamonds (why, we know not) as Vicar Denn.*

Each of these personages is accompanied by his family. Thus:—

*The Queen of Spades is Spade the Gardener's Wife.
The Knave of Spades is Spade the Gardener's Son.
The Ace of Spades is Spade the Gardener's Servant.
The Ten of Spades is Spade the Gardener's Dog.*

The remaining queens, knaves, aces, and tens hold like relations to the *Good-natured Man*, *Club the Constable*, and *Vicar Denn* respectively.

The number of players is unlimited, but four or five make the best game. The cards are dealt face downwards in the usual way. Each player looks at his hand, and takes note which of the families are represented in it. The object of each player is to get the whole twenty cards into his own hand, this being done by a series of requests for given cards from other players, any such player being bound to hand over the card asked for, if he chances to hold it.

The game proceeds as above until all four families are completed, but are probably in the hands of different holders. The player who last completed a family is now entitled to ask any other player for a given family, and then another, and another, till he either, by making a mistake as to ownership, forfeits the right to call (which in such case passes to his adversary), or has got all four tricks into his own hand.

It is best to call from a single card rather than from a suit of which you possess two or more, unless indeed the adversaries are aware that you do so. Further, a good player will not attempt to complete a family right off, but will endeavour to puzzle his competitors by asking for first a member of one and then of another family, so that it may be less easy to remember what suits he has demanded, and consequently what cards he is likely to hold.

HAPPY FAMILIES.

THIS is practically the same game as *Spade the Gardener*, save that it is played with a special pack of cards, manufactured for the purpose. The families are here more numerous, being eleven in number, but there are only four, instead of five, members in each.

The respective heads of families, who are pictorially represented with the implements of their several trades in humorous style, are as under:—

*Block the Barber.
Bones the Butcher.
Bun the Baker.
Bung the Brewer.
Chips the Carpenter.
Dip the Dyer.
Dose the Doctor.
Grits the Grocer.
Pots the Painter.
Soot the Sweep.
Tape the Tailor.*

Each is accompanied by his wife, son, and daughter, each on a separate card, so that the pack consists of forty-four in all, and allows of a somewhat greater number of players than can conveniently take part in *Spade the Gardener*.

To make the game more interesting, a certain number of counters are contributed by each player to form a pool. The player to the left of the dealer then begins by asking some other player for any card he pleases, bearing in mind the condition that he can only ask for a family of which he already holds one or more members. Should he ask for a card which the player addressed does not hold, the regular reply is "*Not at home*," and so the game proceeds, as already described for *Spade the Gardener*, until all the families are completed, and turned down as tricks before various members of the party.

The player holding the greatest number of tricks is now entitled to take half the pool, after which the game is continued by the last querist asking for a given family from any one he believes to possess it. As there are in this case eleven families, and these are probably divided between three or four players, it is not always easy to remember how they are located.

Only those who hold tricks take part in this phase of the game, which does not in any case last very long. The player who finally succeeds in uniting all the families in his own hand takes the remainder of the pool.

ECARTÉ.

ECARTÉ is an admirable game for two players. It is played with the "piquet" pack of thirty-two cards. In point of value the ace holds at Ecarté a very peculiar position, ranking *between the knave and the ten*, so that the order of the cards in play is king (highest), queen, knave, ace, ten, nine, eight, seven.

The players cut for deal, the player cutting the *highest* card, according to the scale above given, dealing. The dealer distributes to each five cards, not singly, but first two, and then three to each player, or *vice versa*. The eleventh card is turned up to fix the trump suit. (Should the turn-up card be a king, the dealer scores one point.) The *talon*, or stock, is then placed at the left hand of the dealer.

The players look at their hands. Should the elder hand (the non-dealer) hold cards so good that he does not desire to exchange any of them, he proceeds to play, leading any card he pleases. If otherwise, he "asks for cards," saying "*Je propose*," or "I propose." If the dealer has a very strong hand, he refuses; if otherwise, he accepts; signifying his so doing by asking "how many?"

It should here be mentioned that the non-dealer playing without proposing, or the dealer refusing to give cards, is considered as undertaking to win "the point": i.e., three out of the five tricks. If he fails to do so his adversary scores *two* points (instead of *one*, as would otherwise have been the case), and as the player who scores five points is the winner, this is a matter of considerable importance. With a moderate game, therefore, the risk should not be run.

If the elder hand plays without proposing, the dealer is likewise debarred from exchanging any of his cards.

We will, however, suppose that the non-dealer has proposed, and that the dealer has accepted. The non-dealer may in such case exchange any number of his cards, from one to five inclusive. He says how many he desires, and at the same time "discards" the same number of cards from his hand, laying them face downwards on the table to his right hand. The dealer does the same with

his discard, placing it at his own right hand, and then gives first his adversary, and then himself, a like number from the *talon*.

If the non-dealer is even now dissatisfied with his cards, he may again propose, and the dealer has, as before, the option of accepting or refusing, but in this case he incurs no special liability by a refusal. This continues until either the non-dealer is content with his hand as it stands, or the dealer refuses to give any further cards.

Should either player hold the king of trumps, he must announce it before beginning to play, and on so doing is entitled to score one point. The usual phrase is "I mark the king," or simply "king," marking it accordingly. The dealer holding the king may wait his own turn to play before announcing it.

The non-dealer leads any card he pleases, and the dealer plays to it; the two cards constituting a "trick." The second player must always follow suit if he can, and must also head the trick if he can: i.e., play a higher card than the one led. The higher card of the suit led wins the trick. If the second player has no card of the suit led, he is bound to trump if he can. The winner of one trick leads to the next.

THE SCORE.

The player who succeeds in winning three out of the five tricks gains the point, and scores one. Four tricks make him no better, but if he wins all five; he gains the *vole*, which scores two.

As already stated, if the non-dealer plays without proposing, or if the dealer refuses and fails to make three tricks, his adversary scores two. The adversary in this case gains nothing further by winning the *vole*.

Five points constitute "game."

Hints for Play.

The first desideratum for the *Ecarté* player is to be thoroughly acquainted with what are called the *Jeux de Règle*, or hands which should be played without proposing. These are summarised by an eminent authority ("Cavendish") as follows:—

JEUX DE RÈGLE.

1. All hands with three trumps.
2. Hands with two trumps, which contain also:—
 - a. Three cards of a suit.
 - b. Two cards of one suit, one being as high as a queen.
 - c. Two small cards of one suit, the fifth being a king.
 - d. Hands intermediate between b and c.
 - e. Three cards of different suits, as high as king, knave, and a small card, or of equivalent trick-making value.
3. Hands with one trump, which contain also:—
 - a. A tierce major.*
 - b. Four cards of one suit, one being a king.
 - c. Three cards of one suit, one being as high as a queen, and the fifth being a queen.
4. Hands with no trump, which contain four court cards or three queens."

The above list should be committed to memory, and known so thoroughly that the player can see at a glance whether the cards he holds come within either of the above categories. It should be noted that the number rather than the value of the trumps is considered; the fortune of war at *Ecarté* more often de-

* King, queen, and knave of same suit,

pending on the trumping of the adversary's winning plain cards, for which purpose small trumps are as good as large ones.

With regard to the dealer's course of action as to accepting or refusing, this will be governed by very much the same considerations. If the non-dealer proposes, it may be taken for granted that he does *not* hold a *jeu de règle*. If the dealer does hold such a hand, he is fairly warranted in refusing.

Next comes the question what cards should be discarded; and here the approved practice is to *throw out all except trumps and kings*, bearing carefully in mind, however, what cards you have discarded, as the so doing may assist you materially in playing the hand. It is not desirable to exchange *less than three cards*, unless you hold the king of trumps, in which case, knowing that you already hold the best trump, and that no amount of exchanging can give it to your adversary, you may endeavour to make an already strong hand still stronger in the hope of winning the vole. With this exception, it follows from the above rule that all hands from which only two cards can be discarded without parting with a king or a trump should be played without proposing.

With regard to the play of the hand, it is customary, holding three trumps (or two honours in sequence), to lead one of them. With less than three trumps, the general rule is to lead the highest of a plain suit of which you hold two or more. If the card wins, it is usually wise to lead the same suit again, unless you have king or queen of trumps, in which case this card may be led to advantage before continuing the suit.

Finally, remember that at *Ecarté* much depends on concealing your strength or weakness. A practised player, having dealt, will not even look at his cards till his adversary has decided whether to "play" or "propose," lest he should by the expression of his own countenance assist his opponent to a decision.

CASSINO.

THE game of Cassino is usually played by two persons, though three or four may take part. We shall first describe it in the two-handed form.

The pack of fifty-two cards is used. The players cut for deal, the lowest dealing. The cards are dealt either by two or by four at a time, four cards to each player, with an extra hand, known as the *lay-out*. The order of dealing is first to the dealer's adversary, next to the lay-out, and lastly to himself. The lay-out cards are dealt face upwards.

The primary object in this game is to capture cards, and this may be done in four different ways. Of these the simplest is—

1. **PAIRING**—i.e., playing a corresponding card to one or more already on the table. Thus, if there chance to be a king among the cards of the lay-out, the elder hand (who is first player) may by playing a king from his own hand capture the one on the table. Should there be two kings in the lay-out, both will be captured; and so on throughout the game.

The second method of taking is by—

2. **COMBINATION**.—This is an extension of the rule as to pairing. If there are among the cards upon the table a five and four, or a two and seven (together making nine) they may be taken by a nine from the hand of the player whose turn it is to play. Should there be two combinations each of which makes the same total, both are taken by the single card.

3. **BUILDING**.—This consists in playing a card from the hand upon a card or

cards on the table, at the same time naming the aggregate thereby made, when the cards so treated can no longer be paired or otherwise captured separately, but can only be taken by one representing their aggregate value. Thus, if the player chance to hold a three and a nine, and there is a six upon the table, he might play his three upon the six, at the same time calling "nine." This enables him to take both cards with his nine when it next becomes his turn to play. Neither card can now be taken by the adversary with a three or a six, but if he chance to have a nine, he will be in a position to take both. The adversary may, if he thinks it to his interest to do so, "raise the build." Thus if, in the case supposed, he chances to have an ace and a ten, he may play the ace on the three and six, calling "ten," and the three cards can then only be captured by a card of that denomination. A player cannot raise his own build, unless in the meantime it has been raised by the opposite player.

4. **CALLING.**—This means that the player having two cards, each equivalent to some combination on the table, instead of at once "taking," as he might do, with either of them, plays one of them upon the cards upon the table, and "calls" the value of the two, in anticipation of taking both by means of the corresponding card in reserve, when it next becomes his turn to play. Thus, if he held a couple of sevens, and there are a four and a three upon the table, he lays one of his sevens upon them, and calls "sevens." If he is not anticipated by his adversary, he will take both with his remaining seven when it is next his turn to play. Should there be, in addition, a five on the table, and he chance to hold a two, he may at the same time play the two on the five, when the call of "sevens" will cover these cards also.*

It is to be particularly noticed that in "building," the player always names the number of the build in the singular, as "ten"; in "calling," the plural is used, as "tens."

When neither player can by either of the means above described take any more cards, or when the original hand of either player is exhausted, four more cards are dealt to each, and so on till the whole of the pack is exhausted. Any cards not taken at the close of the game belong to the winner of the last trick.

Should a player be fortunate enough at any given stage of the game to capture all the cards exposed, this is known as a "sweep," and (unless the opposite player likewise makes a "sweep") counts one towards the game. Should both make sweeps, the difference only is scored. The winning card of every sweep is kept face upwards, and if, at the close of the game, it is found that one player has made three and the other one sweep, the difference, two, will be scored by the former. Whenever one sweep is cancelled by another, the sweep card is turned down.

The exhaustion of the pack terminates the game. Each player looks over the cards he has captured, and proceeds to score, according to the scale following:—

	Points.
For Great Cassino (ten of diamonds)	2
„ Little Cassino (two of spades)	1
„ cards (the greatest number)... ..	3
„ spades (the greatest number)	1
„ each ace	1
„ each sweep (in excess of the adversary)	1

In the event of a tie, the game is drawn.

* The object of calling is to take as many cards as possible, the majority of cards reckoning three to the score.

TWENTY-ONE POINT CASSINO.

The game does not in this case end with the exhaustion of the pack, but is continued (the former elder hand dealing) until the one or the other player has scored twenty-one points. Sweeps in this case do not cancel each other, but are scored as soon as made.

THREE AND FOUR-HANDED CASSINO.

In the three-handed game, the twenty-one point system is adopted, the player who first reaches that number being the winner.

In the four-handed variety, A and C become partners against B and D; partners facing each other and combining their scores, as at whist.

LAWS OF CASSINO.

The laws of Cassino are tolerably brief, and as they cover several points which might otherwise occasion difficulty, we think it well to quote them at length. They are as under:—

1. The deal is determined by cutting, and the player cutting the lowest card deals. Ties cut again. In cutting, ace is lowest.

2. Each player has a right to shuffle, the dealer shuffling last.

3. If, in cutting to the dealer, or in re-uniting the separated packs, a card be exposed, there must be a fresh cut.

4. The dealer must deal the cards either by two or by four at a time, first to his adversary, next to the lay-out, and lastly to himself. The laid-out cards are dealt face upwards. After the first four cards thus dealt are played, four more cards must be similarly dealt to each player, but none laid out. This is repeated at the close of each hand of four cards, till the pack is exhausted.

5. If the dealer deals without having the pack cut, or if he shuffles the pack after it has been cut with his consent, the opposing side may claim a fresh deal, provided they do so before any cards of the lay-out are turned up for use. In such cases the cards must be re-shuffled and re-cut, and the dealer must deal again.

6. If a card is faced in the pack, or if the dealer, while dealing, exposes any of his adversary's cards, previous to turning up any of the cards in the lay-out, the opposing side may claim a fresh deal. If the card is exposed or discovered to be faced after any portion of the lay-out has been turned up, the opposing player may keep it or reject it; if he reject it, the dealer must place the rejected card in the middle of the stock, and deal a fresh card from the top of the same.

7. If the dealer give to himself, or to the opposing player, too many or too few cards, it is a misdeal, and the dealer forfeits the game and all depending on it.

8. If a player makes a build, or calls a certain combination, and it is subsequently discovered that he holds no card of the proper denomination to make such build or combination, the same shall be broken up, and the opposing player may use the separated cards in any legitimate way or ways he may choose, and, until he shall have done so to the fullest extent possible, the offending party shall not be allowed to play again.

9. If a player makes a build, his adversary cannot raise the build by employing for that purpose any card upon the board. The denomination of a build cannot be changed save by a card played from the hand.

10. Should a player make a build, and his opponent decline to build it up higher, the first player may not alter his build, but must take it with a card of the same denomination. He may, however, make another build, or he may pair or combine any other cards, or capture an opponent's build, before taking up his first build, but he must comply with one or other of the above conditions before playing a card which will not do either.

11. When a card is played for the purpose of building or calling, the player must declare the denomination of the proposed build or call audibly and distinctly, so that no doubt of his intentions may exist; and, failing to comply with this requirement, his opponent may separate the cards, and employ them in any lawful way he may deem to be to his advantage.

12. If a player, when taking a build or any other combination, should take up a card or cards which do not belong to the combination, the delinquent player must not only restore to the lay-out the card or cards thus improperly taken up, but also all the cards that properly composed the combination.

13. Tricks that have been taken and turned down must not be examined until all the cards have been played; nor may any trick but that last won be looked at. Should a mistake occur, it must be challenged before another trick is completely played, or the right to challenge it is at an end.

PIQUET.

PIQUET is played by two persons, with the pack of thirty-two cards only, known from that circumstance as the "Piquet" pack. The cards rank in whist order: viz., ace (highest), king, queen, knave, ten, nine, eight, seven. The game is of French origin, and the majority of the technical terms used therein are derived from that language. As we shall have frequent occasion in the course of our description to use such terms, it may be well to explain them beforehand, premising that the score is made partly by the cards held in the hand, and partly in the course of play.

TECHNICAL TERMS USED IN PIQUET.

Carte Blanche.—If among the twelve cards dealt to either player there is no court card, he is said to have *carte blanche*, and scores ten points, taken in precedence of any other score.

Point.—This means primarily the greatest number of cards of one suit. If both players are equal in this respect, the pips are counted, an ace counting as eleven, court cards as ten each, and all other cards according to the number they bear. Each card of the point scores *one*.

Threes (of any given card).—The same card (in point of rank) thrice repeated (as three knaves or three sevens), counting *three* points.

Quatorze (of any given card).—The same card (in point of rank) four times repeated (as four aces or four tens), counting *fourteen* points. There is no difference in scoring value between any two quatorzes, but that consisting of the higher cards takes precedence of the other, and prevents it from scoring. Thus, if the one player hold a quatorze of aces, and the other a quatorze of kings, the former alone can score. Further, should he hold a second quatorze of lower rank, as a quatorze of tens, he scores this also. (The same rule applies to threes.)

Tierce.—Three cards of the same suit in sequence, reckoning *three* points. Ace, king, queen in sequence constitute a *tierce major*, taking precedence of king, queen, knave, the next tierce; and so on down to nine, eight, seven (the tierce of lowest rank), known as *tierce minor*.

Quart.—Four cards of the same suit in sequence, reckoning *four* points.

The rules of precedence laid down for tierces apply to a *quart*, as also to a *quint*, *sixième*, *septième*, or *huitième*, next described.

Quint.—Five cards of same suit in sequence, reckoning *fifteen* points.

Sixième.—Six cards of same suit in sequence, reckoning *sixteen* points.

Septième.—Seven cards of same suit in sequence, reckoning *seventeen* points.

Huitième.—Eight cards of same suit in sequence, reckoning *eighteen* points.

Pique is where the elder hand counts thirty or more *in hand and play* before the adversary scores one, in which case thirty points are added to the actual score of the former.

Repique is where either player counts thirty points *in hand alone* before his adversary can count one, in which case sixty points are added to the actual score of the former.

The Cards are scored by the player making the majority of tricks, counting ten points.

Capot is where either party makes every trick. This counts *forty* points.

THE DEAL.

The players cut for first deal, he who cuts highest being entitled to choose whether he will deal or not. In cutting at piquet, the ace (contrary to the rule which prevails at most other games) is regarded as highest card.

Each player has the right to shuffle, the dealer last. The pack is then cut by the non-dealer, otherwise known as the elder hand.

The dealer may deal by two cards at a time, or three at a time, but must

continue as he begins. Twelve cards are to be given to each player. The remaining eight cards are laid between the players, and constitute the *talon*, or *stock*: the first being the French, the latter being the English term.

CARTE BLANCHE.

If on receipt of his cards either player finds that he has among them *no court card*, he is entitled to score ten for *Carte Blanche*, which he declares accordingly. He need not, however, show his cards till his adversary has discarded.

THE DISCARD.

Before commencing play, each player has the right to discard a certain number of his cards, and take others (from the top of the *talon*) in their place. The elder hand begins. He *must* discard *one* card, and *may* discard two, three, four, or five. If he takes less than five, he may look at the cards next following, up to that number.

It then becomes the dealer's turn. He *must* discard *one* card, and *may* discard as many as are still left in the *talon*, or any less number. If he does not take all those remaining, he is entitled to look at them, but in such case the adversary acquires a similar right. He cannot, however, exercise it till he has played his first card, or declared the suit he intends to play.

THE CALL.

Each player having discarded at his pleasure, the elder hand proceeds to call: *i.e.*, to declare the scoring elements in his hand. The order in which these are taken is as follows (1) The point; (2) sequences; (3) quatorzes or threes.

The elder hand declares his point: *i.e.*, the largest number of cards he may have of any one suit—say, five. (The suit need not at this stage be specified.) If the dealer has not so many cards of any one suit, he intimates the fact by saying “Good,” when the elder hand proceeds to score one for each card. If the dealer has a greater number of any given suit, he says “Not good.” Should he declare “equal,” each party counts the pips of his cards, and the holder of the highest number scores one for each card. In the event of absolute equality, neither scores.

When a given point has been allowed as *good*, the adversary may claim to see the cards which constitute it. When the dealer has declared the point of the elder hand *good* or *not good* (as the case may be), the latter proceeds to name his best *sequence*, which is, we will suppose, *a quint to a king—i.e.*, king, queen, knave, ten, nine. The dealer again has to examine whether he has anything better—*i.e.*, a sequence consisting of a greater number of cards (as queen, knave, ten, nine, eight, seven), or a sequence of like number, but starting from a higher card, as a quint to an ace. He declares the sequence *good* or *not good* accordingly. If *good*, the elder hand is entitled to score in addition any other sequence he may possess.

The elder hand then proceeds to name any quatorze or three (otherwise called a *trio*) which he may possess: say, a quatorze of queens. This can only be beaten by a quatorze of kings or aces. If declared to be *good*, the elder hand not only scores the quatorze in question, but any other quatorze or trio which his hand may contain.

Though the elements of the score are thus discussed *separately*, the player does not mark them one by one, but waits till the whole are ascertained, and then marks the total. He then plays any card he pleases, recapitulating the number he has scored, *with one additional for the card he has first played*, the leader to a trick at piquet being entitled to score one point for the card led. If the

adversary wins it, he too scores a point, but if it falls to the leader, he is "no better."

Before playing to the trick, the dealer proceeds to call and mark the scoring elements in his own hand, which he has declared to be *not good* in the case of his adversary. This done, he plays to the trick; recapitulating the amount of the score marked, with or without one point additional according as he does or does not win the trick. There are no trumps at piquet, but the second player must follow suit if he can, and the highest card of the suit led is the winner. If the second cannot follow suit, the trick is lost.

The winner of each trick leads to the next, calling another point for the card led. Thus, if his score was previously twenty-three, he will call twenty-four. If his adversary, having (say) a previous score of nineteen, wins the trick, he will call twenty. If not, he will repeat the amount of his former score: nineteen. The winner of the last trick scores one point, and the winner of the majority of tricks—i.e., seven or more out of the twelve—adds ten to his score for so doing.

"Game" is usually one hundred up. We have now to notice certain exceptional scores which may be made in the course of play, and the gaining of which greatly accelerates the *dénouement*.

PIQUE.

Should a player, through having less than thirty in his hand, be able by play to complete thirty before his adversary has scored one point, he is said to win Pique, and adds *thirty* to his normal score.

N.B.—Pique can never be made by the dealer, because his adversary, having the right to lead, necessarily scores one for the first card played.

REPIQUE.

Should either player score thirty by his *cards alone* before his adversary has scored anything, he makes a Repique, and adds *sixty* to his normal score. Then suppose that the player's point is six: that he has a quint, a tierce, and a quatorze (the quint and quatorze being respectively *good*), he will score $6 + 15 + 3 + 14 = 38$, which, by virtue of the Repique, is increased to 98.

Neither Pique nor Repique can be claimed in the event of the opposite player holding *Carte Blanche*, as the last-named score takes precedence of any other.

CAPOT.

If either player succeeds in gaining the whole twelve tricks, he scores forty points for the *Capot*, instead of, as usual, ten for the cards: i.e., the majority only.*

Hints for Play.

The first care of the player should be to note whether he holds *Carte Blanche*. He has next to decide how many, and which, cards to discard. With an indifferent hand, the elder hand should avail himself of his full right to discard five cards, inasmuch as each that he leaves may be a possible gain to his adversary. With a good hand this policy must be modified, for it would obviously be unwise to throw out valuable cards on the mere chance of taking in something of greater value.

The first consideration of a good player, unless he holds cards of extraordinary value in some other direction, is usually the *point*. Gaining this makes practically a difference of ten or more to the score, for taking the point as six—which is about the average—it not only scores that number to the holder, but

* Should the player after his discard still hold *Carte Blanche*, it may again be scored.

prevents his adversary from scoring (say) one less. The difference to the score is therefore $6 + 5 = 11$. If, then, you have a suit long enough to give you a fair chance of *point*, be chary in discarding from it.

The next consideration is *the cards*, which on the same principle make a total difference of twenty-two or more to the score.* For this purpose you will naturally endeavour to retain high cards, as probable trick-makers.

Where—as will often happen—the two *desiderata* last mentioned clash, you must decide as best you can between them. Where your longest suit consists of low cards, and its retention would necessitate your throwing out certain winners, it is often wise to select some other suit for *point*, and discard from the long suit. Should the long suit form a quint, it should certainly be retained.

In discarding it is wise not to break into more suits than you can help. On the other hand, retain an ace or king, or a small card which acts as guard to a king: also any card which forms part of a quatorze. As between cards in sequence and cards not in sequence, it is better to retain the former.

The first lead should usually be from the suit selected for *point*, unless you have a head sequence in some other suit, in which case it may be led first. Before leading, however, try to infer from your own hand what is likely to be against you, as any information in this particular will be a valuable assistance in play.

Try your utmost to secure the seventh trick, as this scores “the cards” in your favour.

RUBICON PIQUET.

The old-fashioned game of piquet was, as we have stated, 100 up (sometimes varied to 101). It is now, however, superseded at the clubs by what is called *Rubicon Piquet*. The players here aim at no definite number, but each deals three times, the six games thus played constituting a *partie*, and the player who makes the highest aggregate score being the winner.† But the precise value of the game has still to be ascertained. To do this, the winner deducts the score of the loser from his own, and the difference, *plus* 100, is the value of the game. Thus, suppose that the winner has scored in the six deals 120 points, and the loser 105 only. The value of the game is $120 - 105 + 100 = 115$.

Should, however, the loser not have reached the score of 100 points, known as the *Rubicon*, a different rule comes into operation. The winner, instead of deducting the loser's score, adds it to his own, *plus* 100, as before. Thus, suppose that the winner has scored 120 and the loser 95 only, the value of the game will now be $120 + 95 + 100 = 315$ points.‡

BÉZIQUE.

BÉZIQUE is played with the “piquet” or thirty-two card pack, but duplicated two, three, or four such packs (shuffled together) being used, one pack for each player engaged. The cards rank as under: ace highest, ten next, then king, queen, knave, nine, eight, down to seven, which is the lowest card.

* i.e., $10 + 10 = 20$, with two additional for last trick.

† If there is a tie, each player deals once more. In the event of a second tie the *partie* is drawn.

‡ There is an authoritative Code of Laws for Piquet, but it is too voluminous for quotation in the present pages. Any one desirous of more minute information will find it in “The Laws of Piquet, with a Treatise on the Game,” by “Cavendish.”

Each set of *bélique* cards is usually accompanied with a corresponding number of "markers," for recording the score. These sometimes take the form of dials, each marking tens and hundreds. The score may also be kept by means of counters, which must be of different sizes or shapes, representing different values.* The game for two players is usually played one thousand up. This looks a formidable amount to make, but as every item scores some multiple of ten, it is soon reached.

The deal is decided by cutting, but contrary to the usual rule in card games, the player cutting the *highest* card (in the order of value above given) deals. The cards having been cut by his opponent, he deals eight cards to each, in the following order: first, three cards to each, then two to each, finally three to each, as at first. The next card is turned up to decide the trump suit, and the remainder of the pack (or "stock") is placed face downwards between the dealer and his opponent. Should the turn-up card chance to be a seven, the dealer scores *ten*.

Play then begins, the object of the players being to score first as many aces and tens as possible (each such counting ten to the player winning the trick which includes it), and secondly, to hold in hand, and declare, by placing them on the table, certain combinations or groups of cards, known as "*Bélique*," "*Double Bélique*," "*Sequence*," "*Marriage*," and "*Royal Marriage*" respectively; or groups of four aces, kings, queens, or knaves. Each such combination has an ascertained value, as shown in the following table of scores:

TABLE OF SCORES.

	Points.
<i>Bélique</i> —the Queen of Spades and Knave of Diamonds	40
Double <i>Bélique</i> —all four <i>bélique</i> cards exposed and declared at one time †	500
Sequence—ace, ten, king, queen, and knave of the trump suit	250
Common Marriage—king and queen of any suit other than trumps	20
Royal Marriage—king and queen of the trump suit	40
Four Aces (of any suits) declared together ‡	100
Four Kings " " " " " " " " " " "	80
Four Queens " " " " " " " " " " "	60
Four Knaves " " " " " " " " " " "	40
The seven of trumps turned up	10
Playing the seven of trumps (except during last eight tricks)	10
Exchanging seven of trumps for trump card	10
Winning the last trick	10
Each ace and ten in the tricks of the scoring player	10

Each player now takes up his cards, and the non-dealer, looking over his hand, and keeping such cards as are most likely to help in making any of the combinations above mentioned, plays one of the remainder. It is not incumbent on his opponent to take the trick: indeed, it is not wise to do so, unless he wants to make a declaration, or the card played be a ten or an ace; but the trick may be taken by playing a higher card of the same suit, or by playing a trump of any

* The set for two players consists of twenty-two counters (eleven for each), representing values as under:—

	Points.
One large red counter	500
Four small red counters (value 100 each)	400
One large white counter	50
Five small white counters (value 10 each)	50
Total	1000

† It will be remembered that, two packs being used, there is a duplicate of each card.

‡ These need not be one of each suit. Thus two aces of spades and two aces of hearts will score. Likewise *any* four kings, queens, or knaves.

value. If the trick be not taken by the second player, it belongs to the first, who turns down the two cards, and may then, if he has in hand the needful cards, make a declaration and score for it. He then takes up the top card of the stock, and places it with his own, so as still to hold eight cards; the other player does the same with the next card, and the winner of the last trick leads to the next. There is no obligation to follow suit.

When either player draws a card that completes a winning combination, he must secure a trick before he can score it, and must then do so before he draws another card from the stock. The player of the seven of trumps scores ten; or, if he prefers it, he may exchange it for the trump card, scoring ten in like manner. When the trump card is one of the sequence (i.e., ace, ten, king, queen, or knave of the trump suit), it is important to watch for the seven of trumps, and exchange it for the trump card at the earliest possible opportunity, or, there being two sevens of trumps, the player may be anticipated by his opponent. The player of the second seven scores ten for so doing. The Queen of Spades and the Knave of Diamonds declared together constitute *Bézique*.*

Double Bézique is scored by declaring the two Queens of Spades and two Knaves of Diamonds simultaneously. The score for this is 500, the largest number that can be made in the game, and consequently the *bézique* cards should be held back in the hope of obtaining this score, unless it becomes clear that it is useless longer to retain them. *Bézique* should first be declared and scored, and then *double bézique* at the next opportunity, thus securing both scores.† The first declaration is made by placing the cards exposed on the table, where they remain till "played" to tricks. The second declaration is made by placing the remaining cards of the combination by the side of the former. If in the meantime either of the *bézique* cards already declared has been used in play, the higher combination cannot be scored.

A declaration of *Marriage* is made by exposing on the table together the king and queen of any suit. If it be of the trump suit, it is called a *Royal Marriage*, and scores forty. Kings or queens once "married" cannot be again used for marriages, but may enter into higher combinations, as sequence, four kings or queens, or *bézique*. Cards once declared cannot be used again for another combination of the same kind, though they may enter into any other combination requiring additional cards. Only one declaration can be made at a time, and kings or queens which have formed part of a four-king or four-queen combination cannot afterwards be used for marriages. On the other hand, a queen or king already used for a marriage may afterwards form part of the higher combination.

Sequence is composed of ace, ten, king, queen, and knave of the trump suit. This scores 250, and is much more frequently obtained than *Double Bézique*. It is always worth while keeping sequence cards, unless your opponent shows by his play that he holds duplicates of any card of the series, in which case it is impossible to obtain it. Should you hold *Sequence*, *Royal Marriage* should be scored first, for if you first declare the sequence, you cannot afterwards declare the marriage, being a combination of a lower order.

When the last card of the stock has been taken in, each player will still have eight cards in hand. No further declarations can now be made. The object of

* Formerly, when spades or diamonds were trumps, the Queen of Clubs and Knave of Hearts constituted *Bézique*, but this was found a needless complication, and is now discontinued.

† At a late stage of the game, when the play of the last eight tricks approaches, it is sometimes good policy to declare *double Bézique* in the first instance, lest by first declaring single *bézique* the player may lose the opportunity of making the more valuable declaration.

play is now to secure as many aces and tens as possible, and the *last trick*,* which scores ten to the winner. These tricks are played according to whist rules (save that the ten retains its position next the ace); the second player must follow suit if he can, if not, he is at liberty to trump.

When the whole of the hand is played out, each player looks through his cards for the *brisques*: i.e., the aces and tens they may contain, scoring ten for each. The cards are re-shuffled and cut, and the non-dealer in the last round deals for the next, and so on, until the game is completed.

It often happens that a player has a pretty equal chance to make four aces and four kings or queens, and must sacrifice one or the other. In such case it is usually best to sacrifice the aces, if the opportunity of making tricks with them occurs, for although four aces score higher than four kings or queens, the latter cards can also be used for marriages, whilst the aces, if declared, often fall to the adversary. Players are apt to forget that each ace or ten lost is not only a loss of ten to their own score, but adds ten to that of the opponent, thus making a total difference of twenty.

Some players score tens and aces as soon as made; others all together at the end of the hand. It matters little which practice is adopted, so long as the players agree on the subject.

Hints for Play.

In playing, avoid as long as is possible showing your adversary that you can spoil his Sequence or Bézique, and carefully look out for any indication that he can prevent your scoring them. As every player endeavours to make these, the highest scores, so long as your opponent thinks he has the chance he will sacrifice everything to keep these cards in hand, and you may entirely spoil his play by retaining duplicate cards belonging to these combinations, even though you lose the scoring of one or two marriages by so doing.

Use every endeavour to take the twenty-fourth trick (i.e., the last preceding the "whist" tricks), and in order to do this, try to secure the lead in the trick next preceding, and then lead ace of trumps, if you have it. By so doing you not only score ten, but you are enabled (for the last time) to score any combination you may have in hand, and prevent your adversary from doing so.

THREE AND FOUR-HANDED BÉZIQUE.

In playing three-handed bézique three packs are used, shuffled together. The player to the left of the dealer leads first, and the play proceeds from right to left. In this game Triple Bézique may be made, and scores 1,500. The game may be made 2,000 up, or any higher number; but many players reduce the scores of Sequence, Double, and Triple Bézique to 200, 300, and 500 respectively, and play the game 1,000 up.

Four-handed Bézique is played with *four* packs of bézique cards. Each may play on his own account, or sides may be taken, as at whist, one person scoring for himself and his partner. In this case a player can make a declaration, when either he or his partner has taken a trick.

* This was formerly understood to mean the *twenty-fourth* trick (the last prior to the final eight), but this interpretation no longer prevails.

WHIST.

WHIST, the acknowledged king of card games, is played by four persons, with the full pack of fifty-two cards, ranking in value as follows:—Ace (highest), king, queen, knave, ten, nine, eight, seven, six, five, four, three, two (lowest).

The game is played in partnership, two against two, each pair of partners facing each other. The annexed diagram shows their arrangement and the order of play.

Here A and C are partners against B and D. The order of play is from right to left round the table. Thus, if A be the first player, or "leader," he will be followed by B, C, and D in regular succession.

The four contending players usually "cut" for partners, those cutting the two highest cards playing against those cutting the two lowest.* The player cutting lowest has the right to first deal. Ties (unless they chance to be the two highest cards) cut again, but without prejudice to the position of the other two players as "original high" or "original low." In the event of the "tie" players being the lowest, those two play together, cutting again to decide which of them shall deal. Should three of the players cut like cards, they cut again, without prejudice to the position of the fourth player, as "original high" or "original low," as the case may be.

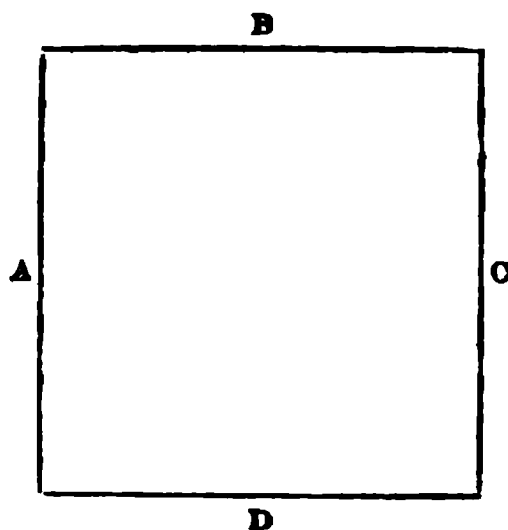
An example will render this clearer. A, B, C, and D cut. A cuts a two, B a nine, C and D each a seven. C and D cut again. C turns up, say, an ace, and D a queen. C will be partner with A, and B with D, but A (as original lowest) retains the right to deal, notwithstanding that C has now cut a still lower card.

Suppose, again, that C and D on the second occasion cut a knave and a queen respectively. Both of these are higher than B's card, but C and D do not on that account play together. B was the "original high," and D, having the higher of the two cards now cut, plays with him, while C plays with A.

The next process is to shuffle the cards. Strictly speaking, each player has the right to shuffle in turn before each deal, the dealer shuffling last. But in most companies the pack is shuffled by the dealer's left-hand adversary, and "cut" by his right-hand adversary. To economise time, two packs of cards are used alternately, the adversaries' pack being shuffled by the dealer's partner, while the dealer is distributing their own.

The cards must be dealt one by one face downwards, beginning with the player on the dealer's left hand, and proceeding in regular order round the table, till the whole of the pack has been distributed. The last card is turned face upwards on the table, and the nature of such card determines the "trump suit." The "turn-up" card is the property of the dealer, but he may not take it into his hand until after the first card is played.

Each player now picks up his cards and sorts them into suits, the better to appraise the value of his "hand,"† and to assist his memory in recalling, at a



* In cutting, ace is regarded as the lowest card. Sometimes, instead of cutting, the players each draw and turn up a card from the pack, spread face downwards upon the table.

† The word "hand" has three different meanings at whist. They are perfectly familiar to a whist player, but somewhat confusing to an absolute beginner. The word is used as meaning:—

1. The thirteen cards held by a given player, who is said to hold a good or a bad "hand," according to the nature of his cards.

later period, what cards he has played. This done, the player to the left of the dealer, known as the "elder" hand, leads, *i.e.*, plays any card he pleases, and the other three play to it in regular succession. Each must follow suit if he possibly can. Should he fail to do so, while having a card of the same suit in his hand, he is guilty of a "revoke," which is punishable by the loss of three tricks. These may either be deducted from the score of the offenders, or added to that of their opponents, at the option of the latter. Should all four players follow suit, the highest card of the four wins the trick; and it may be here stated, as a broad general rule for the information of the novice, that the second player usually plays his *lowest* card of the suit led,* on the chance that his partner, who will be last to play, may have a better card than the third player. The third player, as a rule, plays high, and the fourth, who plays on a certainty, wins the trick if he can, unless it has already been won by his partner, the second player. But if either of the two latter players sees that he cannot "head the trick"—*i.e.*, that the best he can do will still fall behind some card already played—he gives up the contest, and "throws away," as it is called, his lowest card of the suit.

Should a given player have no card of the suit led, he has to consider whether his partner is likely to be the winner of the trick. If not, he trumps, *i.e.*, plays a card of the "trump suit," which has a special value; a card of such suit, however low, being entitled to "take" any card, however high, of a "plain" suit. Thus a two of the trump suit will take a plain-suit trick, even though the other three cards be an ace, king, and queen. But the player may be over-trumped: *i.e.*, one of his adversaries may also be short of the suit led, and play a trump a degree higher, in which case the better trump naturally wins.

The winner of a given trick becomes the leader to the next, and this right to lead is a matter of great importance, for by means of a certain system of play, the rudiments of which will be explained hereafter, a skilful player can give his partner very useful hints as to the nature of his hand, and the "lead" which is most likely to assist him.

Four cards, one from the hand of each player, constitute a "trick." The partner of the player winning the first trick for his side gathers the four cards together, and turns them down on the table beside him, doing the same with all tricks won by himself or partner during the remainder of that hand. The tricks are usually placed over-lapping one another, so that it may be seen at a glance how many there are of them.

There being fifty-two cards in the pack, and four played each hand, it follows that there will be thirteen tricks, which will be divided between the adversaries in greater or less proportions. Should the one side have won *six*, and the other *seven* tricks, the latter are said to have won "the odd trick," or, more shortly, "the trick." If the division is less equal, the winners are said to be as many "by tricks" as the tricks they have won *exceed six*. Thus if they have won eight, they are said to be "two by tricks," and so on, each such trick in excess counting one towards the game.

The players may also score by holding more than their share of the honours, *viz.*, the ace, king, queen, and knave of the trump suit. If the one side have *three*, the others will necessarily have *one* only. The difference, described as "two

2. The player himself. Thus the first player, or leader, is known as the "elder hand," and the other three as second, third, and fourth "hands" respectively.

3. The play of all the cards distributed in a given deal. When all are played, the "hand" is over.

Bearing these three different senses of the word in mind, the novice will have little difficulty in ascertaining from the context which of them is intended.

* The exceptions, which are many, will be discussed hereafter.

by honours," scores two points to the holders. Should the one party hold *four*, the other players can have none, and the former in such case score "four by honours." Should each party hold two, honours are said to be "divided," or "easy," and neither party scores in respect of them.

Five points, at "short" whist (which is now alone recognised, save by very old-fashioned players),* constitute a game, but the value of such game varies according to the number of points scored by the adversaries. Thus:—

1. If the adversaries have scored three or four points, the game is a "Single."
2. If the adversaries have scored one or two points, the game is a "Double."
3. If the adversaries have not scored at all, it is a "Treble."

A "Rubber" consists of three games, the winners of two out of the three being said to win the rubber, and scoring two extra points in right of having done so. Where the first two games are won by the same players, the third is not played, but the winners score two points for such third game, as above mentioned.

The ultimate value of the rubber depends in a great degree upon the value of the games of which it is composed. Thus suppose A and C have won two singles, but B and D have previously won a treble. Here the points scored by A and C are $1 + 1 + 2$ (rubber); but from these are deducted the value (3) of B and D's treble, so that the nett value of the rubber is only $4 - 3 = 1$, and a single counter (representing an agreed-on value) would be paid in respect of it. This is the smallest possible value of a rubber; the highest is eight points, made when two trebles are scored by the winning party, and nothing at all by the losers. The score is here $3 + 3 + 2$ (for the rubber) $= 8$ points.

HOW TO PLAY.

When the laws of whist were first introduced, the leading idea of each player was to make the best of *his own* cards, leaving his partner to do the same with his. But it was very soon discovered that this was unsound policy, and that it was far better for each partner to try to help the other. To do this effectually, it was obviously necessary that each should in the first place gain some information as to the nature of his partner's hand, and many of the rules of modern play are expressly devised for the purpose of imparting such information. The knowledge and observance of these constitute the skilful whist player. Everybody knows, for instance, that the first card led is taken to indicate a desire on the part of the player that his partner shall "return" that same suit at the first opportunity, but as between skilled players, it indicates at the present day much more than this. It indicates, with rare exceptions, that that particular suit is the one of which the player has the greatest number of cards. If an ace be the first lead, it is tantamount to the assurance that the player has either not less than *five* cards of the suit, or that he has both queen and knave in his hand. On the other hand, it shows clearly that he does *not* hold the king. King led shows that the player holds either ace or queen of the same suit. Queen is only led when accompanied by knave and ten of same suit, and when the player has no higher card of a "plain suit" in his hand. Knave led indicates that the leader has also king and queen, and at least five cards of the suit.

These few illustrations show what varied information may be imparted, as

* In the game of whist as originally played, now known as Long Whist, game consisted of ten points. At the score of eight honours took precedence of tricks. If either side had scored *eight* points, and one of the players on that side found on looking over the hand next dealt to him that he held two honours, he was allowed, when it became his turn to play, to ask his partner "Can you one?" meaning "Do you hold an honour?" If the answer was in the affirmative, the honours were shown, and the game was at an end. If, on the other hand, either party had reached the score of *nine*, they could no longer count honours.

between players who understand the "whist language," by a single lead. Similar inferences may be drawn from the play of the other players: indeed, there is hardly a card played, from beginning to end, which does not to the instructed eye impart some item of information. Towards the close of a game it is by no means an uncommon thing for four skilful players to know exactly in whose hand each of the remaining cards is situated.

Obviously, this amount of exactness is only obtained by playing strictly according to certain accepted rules, and the beginner can neither have the knowledge to observe such rules on his own part or to draw the legitimate inferences from their observance by others. But this should not prevent him from endeavouring to obtain at least an elementary knowledge of them. If he once masters the cardinal principles of play, and applies them to the best of his ability, he will find his knowledge rapidly increase. His recollection of the rules, and his power of drawing inferences will grow with every game he plays, and without aspiring to the dignity of a *fine* player, he will find that he has insensibly become what is nearly as good: namely, a *sound* player.

There are primarily three ways in which a player may win tricks, namely:—

1. By playing high cards. A player able to lead ace and king successively in all four suits would in all probability make eight tricks, however small his knowledge of the game.

2. By trumping a suit of which the player is short.

3. By establishing and bringing in a "long" suit.

This last phrase demands a little explanation. A *long* suit, in whist language, is one of which the player has more than his fair proportion—i.e., holds *four or more* cards—in which case the chances are against any other player holding an equal number. To "establish" a suit is so to manœuvre that at the latter part of the hand the player shall be left with the best or only remaining cards of that suit, when, if he can secure the lead, each such card has a good chance of making a trick. A player in such a position is said to have the "command" of that suit. The command of a suit is, however, worthless unless the player can "bring it in"—i.e., get the chance of leading it. This is only to be done (save in the case of a smaller card of the same suit being led) by winning a trick in some other suit. Hence the importance of retaining a winning card or cards for that purpose.

Very young players almost invariably try to win tricks after the first and second methods. A novice usually begins by leading out all his aces and kings, after which, if he has a "singleton" (see *Technical Terms*), he leads that, in order to trump on the return of the suit. This is exactly what skilful adversaries would desire. To his aces and kings (which would probably have made, whenever played) they have naturally thrown away their smallest cards, so that the next remaining cards of those suits are now probably in their hands.* In other words, he has lost and they have gained the command of the suits in question.

Secondly, his leading from a short suit in order to trump it on the return, though it may snatch a trick or two at the outset, has still further weakened his hand. If he had in the first instance but a short allowance of trumps, little harm may have been done, but if he had a fairly strong hand—i.e., four or more—he has thrown away the advantage they gave him. It is a matter of the highest importance to be left with the last trump or trumps, as they enable the lead to be regained at the most critical period of the game. With four or five, if he had husbanded them, he would have had a good chance of being left with the "long" (or final) trump, but having, by trumping, reduced his number to two or three, he

* Some few may be in the hands of his partner, but he has only one partner and two adversaries. The chances are therefore two to one against him.

FIFTH TRICK.—D leads the six of hearts, A plays the knave, B the queen (winning the trick), and C the eight of clubs.

SIXTH TRICK.—B leads the ace of hearts, C plays the nine of clubs, D the two of clubs, and A the king of hearts, leaving B the winner.

The game is now practically over. All the trumps are out, and B has the lead. His remaining cards are seven spades, each one of which takes a trick, for no other player has any card of that suit. B and D have thus won the whole of the thirteen tricks.

The above game affords a forcible illustration of the value of the *Long Suit System*. Accepting this as the foundation of our play, let us now see how it may best be put in practice.

THE LEAD.

The first desideratum is obviously for each player to intimate to his partner, at the earliest possible opportunity, what is his long suit. This is so fully admitted that it is now an invariable rule (save where, for special reasons, a trump lead is to be preferred) *to lead always from the player's longest plain suit*.

But, as we have already stated, the lead may not only convey the fact that so-and-so is the player's longest suit, but may also be made to indicate, to a player who understands the language of whist, the degree of his strength in it. This is done by laying it down as a rule that holding a particular combination of cards of the long suit, such and such a card, and no other, shall be led. The precise card to be led from each combination has been settled by the common consent of scientific players. For the purpose of the novice, it will suffice if he knows, as a matter of rote, what card to play from a given combination. And this is not a very difficult matter, if attention be given to a few simple rules. The first is, as we have already indicated:—

Let your original lead be from your longest plain suit.

It must be remembered that a suit may be *strong* in two ways—in point of *value*, and in point of *number*. Thus, anyone can see that ace, king, queen are in point of value stronger than nine, eight, seven, six, five, but a skilled player would always lead from the latter suit: *i.e.*, the *numerically* stronger. He knows that his high cards will in all probability make whenever and by whomsoever the suit may chance to be led, but the only chance of making any part of his long suit is by forcing out the cards of higher value in it.

Having determined on the suit, you have next to decide which card of such suit to lead. Being, according to our hypothesis, a *long* suit, it must consist of four or more cards. *Is the king one of them, and, if so, is it accompanied by the next higher or next lower (namely, the ace or queen of same suit)? If so, the king is to be led.**

From the above rule follows another; it is merely stating the same thing in another way, but you will find it an aid to memory to bear it in mind. *Ace or queen is never to be led if you have the king in your hand.*

If you have *not* the king, but have the ace, note whether you have *five* or more of the suit, and if so (whatever such cards may be) *lead the ace*. If as well as ace you have both queen and knave, you should still lead the ace, though your suit consists of four or even three cards only.† Otherwise, a small card, as hereafter to be explained, must be played.

* For these rules as to the leads, etc., we are indebted to the "Whist Manual" of Mr. R. F. Foster, an eminent American whist teacher. This little book is a most valuable contribution to the practical acquirement of the game. Mr. Foster does not claim to originate new principles, but he has simplified the expression and practical application of old ones in a way for which every whist player owes him a substantial debt of gratitude.

† A lead from a three-card suit is, generally speaking, very undesirable, but it may be that the player has three cards of each plain suit, and four of the trump suit only. In each case he should lead from such one of his plain suits as is strongest in point of value.

Next, as to the cases in which it is right to lead the *queen*. Our first rule on this subject will be negative: namely, *Never lead queen if you hold ace or king*. These cards being absent, the rule on the subject may be stated as follows:—

If you have three cards in sequence headed by queen, lead it.

The cases in which the knave is led form an exception (the only one) to the rule that the king is to be led whenever it is accompanied by the next higher or next lower card. If you have king, queen, and knave (without ace), and the suit consists of five or more cards, knave, and not king, should be led.*

The *ten* is only led from one combination: namely, *king, knave, ten, with or without small cards*.

We have now gathered in a small compass all the cases in which it is right to lead ace, king, queen, knave, or ten. All cards below these are treated by Mr. Foster under the generic appellation "small cards." Any suit which does not admit of a lead from one of the higher cards above named involves the lead of a small card, and as to this, Mr. Foster's rule is as under:—

If you have no combination from which it is right to lead a high card, lead your fourth best.

The old rule was to play the smallest, but the practice of playing the fourth best has sundry important advantages. If you simply play your smallest, your partner knows that you have better cards, but cannot tell how many or what they are. But if he knows that you always lead your *fourth best* in such a case, it is clear that you have exactly *three better cards*. More than this: he can calculate with ease how many still better there are against you. This is done by means of what is called the "eleven" rule; another useful little formula, for which the whist world is indebted to Mr. Foster. It runs as follows:—

Deduct from eleven the number of spots on the small card led. The remainder is the number of cards that are held against your partner's suit higher than the one led.

This sounds mysterious, but there is really no magic about it. The cards of a given suit range numerically from two up to fourteen (knave ranking as eleven, queen as twelve, king as thirteen, ace as fourteen). If the player leads, say, an eight:—then, in one hand or another, there are $14 - 8 = 6$ better cards of that suit. But of these he himself (if he has followed the rule of playing fourth best) holds three, so that the number *against* him is $14 \text{ less } 3 (= 11 - 8)$, that is, *three*. The reason of the rule may want a little thinking over, but the rule itself is infallible, and its consequences remarkable, often enabling the partner to infer from the first round the precise cards held by the leader. For it may well happen that he holds some of the superior cards himself, and others may fall from the hands of the opponents. The following is a striking example. Suppose that you yourself hold ace, king, nine, three: that your partner leads the seven, and the second hand covers it with the ten: you win the trick with the king, and fourth hand plays the four. Now, deducting seven (the number of your partner's lead) from eleven, you have four as the number of cards against him. But of these four you yourself hold three, and the fourth has been played by second hand. Your partner's three better cards are therefore queen, Jack, and eight. The second player has no more, or he would have played a smaller card than the ten on a seven led. The fourth player can have nothing smaller than the four, and your partner has therefore the two. The only cards left uncertain are the five and six, which may be with your partner, or may be with the fourth player. In any case

* The object of the exception is to convey information to your partner, who, having confidence in your play, will at once infer that you are either leading the highest of a weak suit, or that you have at least five cards of the suit, headed by king and queen. The cards which fall from the other hands will assist him to the true interpretation.

you know that your partner held at least five cards of the suit, and that you have only to get rid of your ace and nine to leave him in complete command of it.

The young player may deduce from this example two useful lessons: first, the immense importance of playing strictly according to rule, and secondly, the necessity and value of watching the fall of the cards, and at once drawing all legitimate inferences therefrom.

But obviously the "fourth card" rule can only apply where you have four or more cards. If you have no plain suit of this number, and do not feel justified in leading trumps, you must of necessity lead from a three-card suit. If such suit be headed by ace, king, or queen, the rule is to lead the *lowest* card. In any other case (or should queen be accompanied by Jack), *lead the highest card*. Your partner will discover (if not at the first, at any rate at the second round of the suit) that you have led from weakness, and will be warned that you have a very poor hand.

THE PLAY OF SECOND HAND.

The broad general rule is that second hand, in the first round of a suit, should pass the trick: i.e., play his smallest card. It is an even chance that his partner (fourth player) holds a better card than the third player, and by holding back any high card he may possess, he retains some command of the suit.

The rule is, however, at the present day almost as much "honoured in the breach as the observance." Where the second player has great strength in the suits, he would, by holding back, give the enemy a chance to win the trick, and possibly to trump his high cards at a later period. For this reason, holding:—

Ace and king, second hand should play king.				
King and queen	„	„	„	queen.
Ace, queen, and knave	„	„	„	knave.
Ace, queen, and ten	„	„	„	queen.

These are comparatively simple cases. Holding a single honour, with one or more small cards, it is sometimes policy to play the honour. Thus to king led, if you have the ace, play it, for if you pass it, king must win, and your ace may possibly be trumped; to queen led, play ace in like manner. If you have both ace and king, play the king, and hold up the ace until the suit is again led. But holding king only, with small cards, you pass the queen. You know that according to the rules *queen is never led if the holder has a higher card*, and the ace must therefore be either with the third player or with your partner. In either case it is better to reserve your king. The rule laid down by Mr. Foster is as follows: *Never attempt at second hand to take queen, Jack, or ten led with a single honour unless that honour is the ace.*

With ace and queen you should play the ace; with king and queen the queen, —on knave led.

Where a small card is led, apply the eleven rule against the leader; you may find that all the cards against him are in your own hand, in which case you will play the lowest card that will head the trick, and hold up the better cards. Thus you have ace, queen, nine of a given suit, and eight is led. Deducting eight from eleven, you find that there are only three better cards than those held by the leader, and as you yourself hold such three cards, you may play the nine with a confident expectation that it will win the trick. But it may be that no such certainty is open to you, and you are doubtful whether to lead or to pass the trick. In such case Foster's rule is as follows:—

If you hold any combination from which you would lead a high card, you must, as second hand, play one on a small card led.

THE PLAY OF THE THIRD HAND.

Just as the old-fashioned maxim for the second player was "play low," that for the third was "play high," and the principle is undoubtedly sound. There are two reasons for the practice: first, to win the trick if you can, and secondly, *to get a high card out of your partner's way.* The fact that he has led that particular suit is presumptive evidence that he is strong in it, and hopes to make tricks in it later. If you hold back a high card of that suit, you may be forced to win a trick of his at a late period of the hand, and so deprive him of the command.

There are, however, two exceptions to the rule. You should always win a trick as cheaply as you can, and therefore, with a sequence heading the suit, you should play the lowest of such sequence. Your partner, if he is a player, will very soon infer where the remaining cards are. Secondly, *in the first round of a suit*, should you hold ace and queen, you should play the latter, the chances being two to one against the king being held by the fourth player. Should the queen win, you should forthwith return the lead with the ace, in order to get it out of your partner's way.

With this solitary exception, it is not allowable to *finesse* in your partner's lead. If, however, you know him to be a scientific player, you may calculate by means of the "eleven" rule how many cards there are better than those he holds. The nature of the card led will give you still further information, and, comparing the results with your own hand, you may often get a valuable hint as to the best card to play.

THE PLAY OF THE FOURTH HAND.

The fourth player should usually take the trick if he can, and as cheaply as he can. If he cannot head the trick, or if it is already his partner's, he will of course throw away his smallest card.

There are cases in which the fourth player may do well to win the trick, though already belonging to his partner (say, in order to secure the lead, or to get a high card out of his partner's way). On the other hand, there are cases in which it may be wise to pass the trick, in order to retain the command of the suit, or to throw the lead into the hands of the adversaries. The beginner, however, will be well advised to stick to the general rule as above given.

CONTINUING THE SUIT LED.

On the second round of a suit, the maxim—applying equally to first, second, or third player—is, *play the best card if you hold it.* With other cards in sequence, or practically in sequence,* to the best card, play the lowest of them. [The fourth player simply follows his usual rule: to win the trick if he can, and as cheaply as he can.] Where the above rule does not apply, and there is no special indication to the contrary, a beginner should as second player follow the ordinary rule of playing low, or, as third player, of playing high.

RETURNING PARTNER'S LEAD.

The merest novice is aware that it is a prime duty at whist to return his partner's lead, but many players, themselves holding a good suit, open that first, and then return that of the partner. This is doubtful policy, though it may be tolerated if the card led in the player's own suit is certain to win the trick. It should, however, be regarded as a paramount duty that *if you hold the best card of your partner's suit it should be led before your own;* indeed, so fully is this admitted, that the omission to lead such card at once is regarded as tantamount

* As ace and queen, after king is played.

to the assurance that you do not possess it. Having second and third best, the second best should be led, and if you have only two cards of the suit left, whatever their value, the higher should be led. With three cards left, and neither of them a probable winner, you should lead the smallest.

Should your partner have led trumps, you are doubly bound to return his lead on the first possible opportunity. Indeed, it has been jocularly said that there are only two possible excuses for not returning trumps—namely, sudden death and having none.

LEADING TRUMPS.

With five trumps, or four very strong, it is usually considered to be good policy to lead them at once. If you have otherwise a good hand, the wisdom of such a course is obvious, as you thereby clear the way for winning cards, which might otherwise be trumped, and promote the establishment of a long suit. Where you have but a poor hand, leading trumps can do you personally little good, but your partner has probably some long suit, and you may help him to make it. In any case the balance of whist opinion is in favour of so leading. With few trumps you have little chance of drawing the strength of the adversary, and it is therefore better, unless you receive a call for trumps from your partner, to reserve them for their less important purpose—namely, trumping the long suit of your adversaries.

Where it is found necessary to lead trumps, this is done upon a somewhat different principle to that adopted for plain suits, the rules being shortly as follows:—

With ace, king, queen, with or without small cards, lead first queen, then king: with all four honours, knave first, then queen. You here lead the lowest of the sequence, in order to keep the adversaries in the dark as long as possible. The knave winning, your partner will at once know as a certainty that you hold the higher cards. The adversaries will only know that they are divided between you and your partner—a much less valuable piece of information.

With ace, king, and small cards, lead the lowest; unless with six or more, when lead king, followed by ace.

With ace, queen, and small cards, lead the lowest, unless with six or more, when lead ace, then queen.

With ace and small cards follow the same rule.

Holding an intermediate sequence, lead the lowest of the sequence. In other cases, the lowest card.

THE SIGNAL FOR TRUMPS.

It now and then happens that a player wishes trumps led, but cannot get the opportunity of leading them. In such case he can by means of a conventional signal, known as the "call for trumps," communicate his desire to his partner. This is done by a temporary infringement of the accepted rule of winning a trick as cheaply as possible, or in default of power to win it, throwing away the smallest possible card. If a player disregards this rule, and upon a trick consisting of (say) six, three, nine, plays queen, and shortly afterwards the knave or ten of the same suit falls from his hand, he has either been guilty of gross carelessness or (which in the case of a skilled player we may take to be the explanation) he has intimated to his partner that he desires trumps led, and his partner is bound to lead them accordingly at the very first opportunity.

It should, on the other hand, be remembered by the young player that to signal for trumps as above is to assume considerable responsibility. It is practically a command to your partner to throw over his own scheme of play, and adopt yours instead, on the implied assurance that you have so strong a hand that it will be worth his while to do so. In the judgment of eminent authorities, the call for

trumps should never be made unless the player holds at least five, one being an honour; or five, of which two are honours: much the same degree of strength, in fact, as would justify the player in himself leading trumps if he had the opportunity.

DRAWING INFERENCES.

The three great qualifications of a whist player are:—

1. Knowledge of the game.
2. Power of rapid and accurate inference.
3. Memory.

Of these, the first, in an elementary shape, may be gained from these pages. The last is incommunicable, but the habit of *strict attention* will soon remove defect on this score. We have still to deal with inference, one of the most important elements of the scientific game. We say the *scientific game*, for if a player does a thing without himself knowing why he does it, it is clear that no other person can infer the reason, or draw any sound deduction from it. In whist, as played by skilled players, the case is widely different. It has been well said that in true whist every card played is a definite sentence, as explicit as if it were actually spoken. We have seen an example of this at pages 889-890, and the "fourth card" rule mentioned on pages 891-2 affords another illustration. These, however, are comparatively complicated cases. We will take a few more inferences of a similar kind, such as might fairly be drawn by the novice.

It is to be remarked in the first place that the rules as to the "lead" of themselves give rise to sundry direct deductions within the reach of anyone who has the barest acquaintance with them. Thus:—

A king is led. Inference: the player has either ace or queen (possibly both).

An ace is led. The player has *not* the king, but he has in all probability *five* cards of the suit. If he has not five cards, then he holds both queen and Jack.

Queen is led. The player has no higher card of the suit, but has Jack and ten, and in all probability a fourth card.

But the fall of the cards in response to the lead, coupled with the player's knowledge of his own hand, will help him to much more precise information. Let us suppose that of a given suit, say hearts, you have ace, eight, four, three. Your partner, whom we will call A, leads queen, the second player plays nine, the third, C (yourself), three,* the fourth, D, king. Let us see what we can deduce from this combination.

In the first place, the leader has knave and ten, or he would not have led queen. From this it follows that the second player, B, playing the nine, is either beginning the signal for trumps (this will be made clear upon the second round) or he has no more of the suit.

The fourth player, D, having won the trick, leads (say) the king of spades. A plays the five; B the ten; your own hand is ace, knave, six, two. You play the ace, winning the trick. You now know, or should know, a good deal about the spade suit. Also D leading king, and not holding ace, must still have queen in hand; your partner (A) has not the three or four, or he would not have played the five. B's ten is presumably his only card of the suit.† The three and four are therefore with D. The only cards remaining unaccounted for are the seven, eight, and nine, which lie between D and your partner A.

* You might by playing the ace have won the trick, but it would have been very bad play to do so. Your partner by leading queen has declared that he holds knave and ten, and that this is his longest suit. He therefore wants the king out of the way. If you play the ace, the king is held up, and the command of the suit remains for the time being in the hands of the adversaries.

† This is never quite certain at the outset, because, as already indicated, the player *may* be signalling for trumps. Meanwhile, however, it is pretty safe to act on the assumption.

As the winner of the last trick, the lead is with you, and having the highest card (the ace) of your partner's suit, you play that card without delay. D plays the seven, your partner the two, and B trumps. You can now place the whole of the suit. C has no more, for if he had a lower card, he would not have played the seven, and you can account for all above it. The remaining cards, six in number, are therefore divided between yourself and your partner. You have the four and the eight, and he has therefore knave, ten, six, and five, with complete command of the suit. Another round will probably give you similar information as to the spade suit.

We have not space to go more fully into the subject of inferences, for the field is unlimited, each round that is played giving rise to some fresh deduction. But though so infinitely various, the difficulty is no greater on that account, because the rules applied are constantly the same; it is only the application that varies. For their effective use, however, two things are necessary: first, that the player himself shall be thoroughly familiar with the rules on which they are based; and secondly, that his antagonists shall play according to the same rules. The first point is a matter within his own control, and it ought to be a point with every young player that he *will* learn, and *shall* play, according to the accepted rule of the scientific game.

The second *desideratum* he cannot secure: indeed, the novice will too often find himself pitted against players who have little, if any, knowledge of the science of the game. In such a case it is idle to base the usual deductions upon their play, but close observation will often show that though their practice may be wrong, they *do* play according to some sort of system, and an acute observer may still, by taking due note of the fall of the cards, gain information, less precise, but still useful, as to the nature of their hands.

Before finally quitting the subject of inferences, we may pause to reply to an objection which is often urged by the unscientific player. "What is the use," it is asked, "of always playing according to certain fixed rules? Surely the inferences to be drawn therefrom will be equally open to your adversaries as to your partner, and having two adversaries and only one partner, the information communicated must tell against you rather than in your favour."

The objection seems plausible, but it is fallacious. A and C are partners against B and D. Suppose—to put the case as forcibly as possible—that A were permitted at the outset of the game to lay his cards of a given suit face upwards on the table (to which, in practice, strict following of the rules for the lead approximates), the information would no doubt be open to all four players; but it would by no means be equally valuable to all of them. C would know exactly the total strength of himself and his partner, and as a natural consequence the exact strength of the opposing hands. B and D can make no such calculation. Each knows that A has such and such cards, and that he himself holds such other cards of the suit, but he does not, and cannot, know whether the remaining cards are for or against him: in the hands of his partner or in those of the enemy. This information, already open to C, B and D can only gather bit by bit, as the cards fall from the various hands. And so on throughout the game: any item of information afforded being of greater effective value to your partner than it can possibly be even to both your adversaries.

Final Counsels.

1. Familiarise yourself with the rules of the scientific game, and endeavour to apply them. If you fail, do not be discouraged. Persevere, and you will succeed sooner or later.
2. On receiving your cards, look over your hand carefully, and sort it into

suits. Notice how many you have of each. Some players habitually place trumps to the right or left of the hand, but this is unwise, inasmuch as it will often enable an observant adversary to calculate how many you have remaining: an "inference" which it is desirable to avoid.

3. Note the turn-up card, and watch for its fall, as it will often give you valuable information as to the remaining trumps of the holder.

4. Watch the fall of the cards, and at once draw such inferences as it may seem to justify. Note as the game proceeds whether such inferences were correct: you will thus be enabled to estimate the degree of skill possessed by the players, and in particular by your partner.

5. If you find yourself coupled with a partner who has no real knowledge of the game, it is useless to attempt by scientific play to convey to him information which he has not the capacity to understand. Even in such a case, however, it is best to adhere to the broad principles of the scientific game (leading from strongest suit, etc.), but you are no longer bound to play the lowest of a sequence, to throw away your smallest card on a lost trick, etc. Being unable to instruct your partner, you may endeavour to mislead your adversaries.

6. If your partner does not follow suit, ask him pointedly whether he has none of the suit. This is allowable, and may save a revoke, particularly with an ignorant or careless player.

7. Play to the score—i.e., note what the score is, and play accordingly. Thus, if you only want one trick to win, take the *safest* mode of obtaining it. If you have two or three to make, it may be worth while to play a more risky game.

8. Play throughout as carefully to each trick as though on that trick depended the issue of the game.

9. Do not carry on any conversation, but play the game in all its rigour. There will be no enjoyment otherwise.

PARLOUR MAGIC.

IN commencing our Lessons in Magic there is one cardinal rule which we cannot too strongly impress on the juvenile amateur.

Never tell your audience beforehand the exact result you propose to produce, and never perform the same trick twice over on the same occasion. In the first place, half a conjurer's power depends on his audience not knowing exactly *what* he is going to do, and upon his skill in so "misdirecting" their attention at the critical moment that he is enabled to perform the necessary manipulations without attracting inconvenient notice. Further, there is always a *possibility* of the trick not turning out precisely as was intended. The experienced performer feels no alarm at such a possibility. He has plenty of strings to his bow, and if a hitch occurs he terminates the trick in some different manner, as may be most convenient to himself. If he had told the audience beforehand that so and so would take place, they would regard any departure from the result so announced as a failure. As he has not done so, they have no means of knowing that the effect produced was not that originally intended.

A little practical illustration will render our meaning clearer. Suppose that a conjurer, about to perform a card trick, were to commence as follows:—"Ladies and gentlemen, I am about to ask some one to take a card from this pack. After it is replaced and the pack shuffled, I shall make it disappear from the pack and be found in that little box upon the table." Now, to produce the effect announced, certain things have to be done.

1. The conjurer must "force" a particular card.
2. The card being returned, he must "make the pass" to bring it to the top, and "palm" it off.*
3. The box wherein it is to be found must be prepared beforehand with a duplicate card.

But the conjurer has told his audience *too much*. The person invited to draw may not unreasonably suspect that the card to be produced from the box is a duplicate, and that it is therefore essential to the trick that a particular card be drawn. If maliciously disposed, he may determine that he *will not* take the desired card, and may draw some other.† The prepared card in the box is thereby rendered useless, and if the performer has announced beforehand that the card will be found in the box, the trick has failed.

Again, he has expressly told the audience that the card will *disappear* from the pack. This is a challenge to the drawer, if suspiciously inclined, to see that the card, when replaced in the pack, is not again withdrawn from it by the performer, and the difficulty of making the pass, and palming off the card unobserved, is increased in a material degree: so much so, indeed, that in the hands of a tyro the trick would probably break down altogether.

Yet again, the announcement that the card will be found in the box calls the general attention prematurely and too pointedly to the latter, and he may not

* The technical terms here used will be explained in our card section (p. 900 *et seqq.*).

† A person familiar with the expedient of forcing can always, if he determines to do so, avoid taking the card desired to be forced upon him. Such a miscarriage, however, does not disturb a skilled performer. He simply leaves the wrong card in the hand of the drawer, and passes to some more compliant person, afterwards performing some small *extempore* trick with the extra card.

improbably be embarrassed by a request to be permitted to examine it. To refuse would be ignominious, while to comply would ruin the trick.

We will now suppose the opposite case. The performer has not said anything whatever as to the effect he intends to produce, but has simply asked some one to draw a card. There is nothing to suggest that it is of any consequence *what* card may be taken, and in all probability he will "force" the desired card with the utmost ease. He has not said that the card will disappear from the pack, and it is therefore replaced without suspicion, and he is able to palm it off without difficulty. The trick is now done. He quietly drops the card into a pocket or behind his table, and in due course produces it (really the duplicate) from the box.

But the course of events may not be quite so favourable. A cantankerous drawer may, out of what the Americans call "sheer cussedness," have insisted on taking a wrong card. In such a case the card in the box is for the moment useless, but as the spectators do not know that the card was intended to be found therein, no harm is done. The performer has only to vary his conclusion, saying nothing about the box, and find the card, say, under a borrowed hat instead. This feat, which will also be described in the course of our instructions, is performed with the actual card drawn, whatever it may be. The reputation of the performer is saved, and presently he may make a fresh attempt with some other person, and getting the right card drawn, put it in the box, as first intended.

Again, the right card may have been drawn, but the drawer in replacing it may do so in such a manner that it is lost in the pack (this could only happen to a novice), or may keep so close a watch on the performer's hands that the latter dares not venture to "palm" it. In such case he will simply say nothing about the card disappearing from the pack, but simply announce that it will pass into the box. This draws the general attention from the pack to the box, and the card being found therein, not one spectator in a hundred will ever dream of examining the pack to see whether it has really departed.

The non-acceptance of an *encore* is a necessary corollary of the first rule. The performance of the trick on the first occasion has shown the spectators precisely what they have to expect, and they are all on the alert to criticise each step of the process. The little movements which upon the first occasion they took to be accidental, so to speak, are now seen to be essential, and they will, in all probability, find out, if not exactly "how it's done," at any rate enough of the secret to spoil the trick.

There is one important exception to the rule of not accepting an *encore*—namely, where the performer is able either to perform the same trick (in effect) by two different methods, or is acquainted with some other trick having a pretty close resemblance to it, but worked on a different principle. In this case, as the explanation of the one trick will not fit the other, he may safely accept an *encore*, but substituting the second trick for the first. Illustrations of cases in point will be found in the following pages.

But, reverting to what we have said as to the desirableness of not stating beforehand the precise nature of the trick, we can imagine some young reader raising a not unnatural objection. "Why, surely!" he will say, "at the magical performance I witnessed the conjurer talked the whole time about what he was doing." Quite so; the best of wizards tells you constantly what he is doing, or rather, *appears* to be doing (for very often what he actually does is something very different), but he very rarely tells you what he is *going* to do; and when he does so, it is in vague general terms, by no means binding him to any exact fulfilment. This, instead of a hindrance, is a help; indeed, the conjurer's "patter," as it is termed, is one of the most important elements of the trick, and should be studied with quite as much care as the manual portion. It is designed,

in the first place, to keep up the interest of the spectators, which largely depends upon the animation and vivacity of the performer; and secondly, to divert their attention from the hand which is doing the work into some safer direction. Thus, if the performer, after apparently transferring a coin from the right to his left hand, were forthwith to drop it from the right hand into his pocket, nine out of ten of the audience would detect the act. But if, advancing with the left hand closed, as though containing the coin, he says to a lady, "Madam, might I ask you to take charge of this half-crown for me?" every eye is naturally attracted to his left hand, and the right may drop it into the pocket with perfect safety. By the time the left hand is opened, and the lady finds, to her surprise, that nothing falls from it into her own, the deed is done—the right hand has come forward again, empty. All that the audience know is that the coin has somehow disappeared. Meanwhile, it remains in the possession of the performer, to be dealt with as may be needful for the purpose of the trick.

Before quitting the subject of "patter," we must not omit to say a word upon the influence of the "eye." Spectators always watch the eyes of a performer, and wherever he looks they look also, hoping thereby to surprise his secrets. But the skilled performer, knowing this, makes the direction of his eyes an essential part of his business, and when he is doing, say, something critical with the one hand, fixes his eyes upon the other, or some independent object, when the eyes of his audience invariably take the same direction. Thus, in the example we have given, the performer's eyes, in offering the imaginary coin to the lady, would look first at her, then downwards at his left hand (thereby simulating what he would naturally do if he were really handing her a coin). The audience instantly do the same. This effect of the eye is so powerful as to be absolutely certain in the case of an uninitiated person; and even an expert, watching a performance as a spectator, finds it extremely hard to resist it.

The foregoing observations apply mainly to tricks dependent upon sleight-of-hand, but these are, in truth, the great majority. The really good tricks which can be performed without sleight-of-hand are few and far between. On the other hand, there are many simple tricks dependent on some arithmetical or other scientific principle, which by the addition of a little legerdemain are heightened tenfold in effect.

CARD TRICKS.

In the department of card conjuring, the expedients of which the wizard finds the most frequent occasion to make use are the following:—

1. To make the pass.
2. To force a card.
3. To palm a card.
4. To get sight of a card.
5. To make a false shuffle.
6. The bridge.

There are other sleights which we may have occasion to mention, but the foregoing are the most important, and these once mastered, the others will offer but little difficulty.

1. *To make the pass.*—The effect of this sleight, which is the very backbone of card conjuring, is to reverse the positions of the top and bottom portions of the pack, divided at such point as may best suit the purpose of the operator. It is achieved

as follows: The performer, taking the pack face downwards in the left hand, introduces the little finger of that hand nearly as far as the first joint at the point where it is desired that the pack shall be separated. The other fingers lie across the back of the cards, the thumb meeting them on the opposite side. The operator now brings the right hand over the pack in a longitudinal direction, and gripping the lower portion endwise between the thumb and second finger of that hand, presses it into the fork of the left thumb, simultaneously lifting its outer edge, as though on a hinge at that point. Meanwhile, the upper portion is clipped between the little finger below and the three other fingers above it, and by them tilted outwards, till it assumes a nearly perpendicular position. The effect of this movement is that the outer edge of the lower and the inner edge of the upper packet pass each other. The moment they have done so the original lower portion of the cards is allowed to fall upon the other (the fingers of the left hand making way for them), and the pass is complete.

The pass, properly made, should be practically invisible, but it will be some time before the novice reaches this degree of perfection. A half-turn of the body to right or left, or a slight swing of the arms, as the pass is made, will aid materially in covering the movement of the hands, the greater movement calling attention from the less.

2. *To force a card.*—This signifies the compelling of a person to draw a particular card, though to all appearance perfect freedom of choice is allowed him. In effect, the cards are merely spread fanwise before him, and he takes one where he pleases. As a matter of fact, the right card is put before him at the precise moment when his fingers advance to draw, and unless he is acquainted with the sleight he will almost invariably take it.

The card to be drawn is at the outset placed at the *top* of the pack. (If the operator has sufficient skill in sleight-of-hand, he may "palm" it off, as next described, and offer the pack to be shuffled, replacing it in the same position when the cards are returned to him.) From this position he brings it by the "pass" to the middle of the pack. When the pass is made, he does not, as usual, withdraw the little finger, but keeps it bent over the now *lower* portion of the pack, on the top of which the card to be forced lies.

The pack may be closely squared up with the finger in this position, for being at the end of the pack nearest to the body, it is invisible to the spectators. The performer advancing with the request that a card may be drawn, and using both hands, begins to spread the pack fanwise, as if to facilitate the choice, pushing aside the cards one by one with the thumb of the left hand from left to right. He does this in an easy and careless manner, but nevertheless so times the movement that at the very moment the fingers of the spectator advance to draw, the card he desires to force shall just meet them, being at the same time pushed a shade forward from the rest of the pack, when it will in all probability be taken.

Forcing is by no means difficult, but demands coolness and confidence, which are only to be attained by practice. The tendency of a novice is usually to feel too anxious, and to unduly hurry the process, so that the card has passed the critical point before the advancing fingers are ready to receive it. In such a case the only plan is to close the fan promptly, with some such remark as "Anywhere you like, madam," and again spread it, this time it is to be hoped with better success.

Where the taking of a particular card is absolutely essential for the purpose of the trick, it may be rendered a certainty by the use of what is called a "forcing" pack, procurable of any dealer in conjuring apparatus. This is a pack consisting of the same card repeated throughout: the king of hearts, for example. A performer using a pack of this kind need not fear failure, for whatever card

the drawer takes it is bound to be the king of hearts. On the other hand, such a pack has its drawbacks. It must be changed and re-changed for the ordinary pack previously used, and it cannot be handled by the spectators without disclosing its secret. On this account the forcing pack, and indeed any prepared pack, is rarely used by skilled performers, who find it safer to trust to their own fingers.

3. *To palm a card.*—This phrase signifies the secret removal and concealment in the palm of a card, usually the uppermost of the pack.

The pack being held in the left hand in the usual manner, the right hand is brought longitudinally over it, with a forward movement. Meanwhile the left thumb pushes the top card a little way off the pack. The moment that the right hand, in its passage over the card, has reached such a position that the first joints of the second and third fingers are level with its upper edge, the hand is slightly bent, clipping the card lengthwise between such top joints and the ball of the thumb. The hand, continuing its forward movement, carries the card off the pack, lying curved against the fingers and palm. When it becomes desirable to replace the card, this is done by carelessly bringing the right hand over the pack, and letting the card simply fall (from a distance of half an inch or so) into its old position, when a smart pressure of the left thumb across its middle removes any tell-tale "bend," and the card lies flat on the pack, as at first.

The power of palming is extremely valuable when the performer, desiring to have a card drawn, has either not attempted to "force" one, or has been baffled in doing so by an impracticable subject. In such a case he asks the drawer to replace his card, offering the pack fanwise that he may do so. He lets him replace the card just where he pleases, but crooks the little finger (of the left hand) over its right hand bottom corner, makes the pass at that point (so as to bring the card to the top), and palms it off, to be disposed of as may be needful. Should he desire to ascertain its nature, he will employ the sleight following.

4. *To get sight of a card.*—This may be done in two or three ways. If the performer desires to get sight of a card already palmed, he has only to offer the rest of the pack *with the hand in which the card is palmed* to some person, with a request that he will shuffle. Meanwhile, the inside of the hand being towards himself, he has not the smallest difficulty in ascertaining the nature of the card.

There are other methods of getting sight of a card. One of them is to pass the card to the *bottom* instead of the top (this is done by inserting the little finger *below* it when making the pass), when the mere act of transferring the pack from hand to hand will reveal the nature of the card. Yet another method is, without making the pass, to insert the little finger *below* the card, the three other fingers remaining on the top of the pack, and with a careless sweep of the arm before the face (apparently a mere indicative gesture), by the aid of these four fingers to open the pack bookwise to the extent of a couple of inches. The opening, being towards the performer, is invisible to the spectators, so that the operator has ample opportunity to note the required card.

5. *To make a false shuffle.*—This is an expedient designed to keep a card or cards at some given position, although to all appearance the pack is thoroughly shuffled. This may be effected in different ways, varying with the position of the card. If it be at the bottom, the remaining cards of the pack may be shuffled with perfect freedom, provided only that the last half dozen, the undermost of which is the noted card, be finally replaced at the bottom: a perfectly natural proceeding. When the noted card is on the top, the process is not quite so simple, but it offers no serious difficulty. Taking the cards in the left hand, as though about to deal them, you with the left thumb push off the top card (singly) into the right hand, and upon it, by packets of five or six, the remaining cards of

the pack. This done, the noted card is at the bottom, and you may now shuffle the uppermost cards as freely as you please, only remembering to conclude by replacing the noted card on the top.

There are other kinds of false shuffle, which are designed to keep the whole pack in a pre-arranged order. These are a little more difficult: indeed, some of the methods used would be a good deal beyond the reach of the juvenile amateur. The following will, however, answer the purpose very well, and demands but little dexterity. Taking the pack in the left hand, face downwards in the ordinary way, push off with the left thumb into the right hand six or seven of the uppermost cards, and place the remaining cards in packets of three or four alternately above and below the first packet, as usual in the act of shuffling. This, at least, is what you *seem* to do, but the apparent placing of cards *above* the first packet is a sham. Each packet so placed is instantly drawn off again, and placed *below* the right hand packet. As it passes this latter the edges of the two packets should meet, the slight "scrape" thereby caused exactly simulating the sound of the corresponding genuine shuffle.

Another shuffle for the same purpose, which may be used by way of variation, is as follows: You first make the pass, thereby bringing the lower portion (which should be about one-third) of the pack uppermost. You then take the pack face downwards in the right hand, keeping the two halves of the pack from coalescing by slipping the little finger between them. Holding the pack a little above the table, let the cards fall in four little heaps, in the order indicated by the accompanying figures:—

3 1 4 2

One-third of the now lower packet must fall on the spot marked 1, another third on that marked 2, the remainder of the lower packet on 3, and the whole of the now uppermost packet on 4. Now gather the four heaps up again (using each hand alternately) in the following order: With the left hand place heap 1 on heap 4, with the right heap 2 on heap 1, and with the left heap 3 on heap 2. The cards now again form a single pack, and it will be found that their relative positions are the same as at first.

6. *The Bridge*.—It is often desirable to be able to cut the pack at a given spot: that, for instance, where some particular card lies. This is done by means of an expedient known as the "bridge." The method of making the bridge varies according as the card in question lies in the middle or on the top of the pack. If in the middle, the performer, inserting the little finger of his left hand at that point, grips the pack endwise with the thumb and second finger of the right hand, pressing so strongly as to force the ends of the cards nearer together. As a necessary consequence, the central part of the pack is forced outwards on each side, leaving a corresponding concavity, thus (), though of course in a much less degree between the two portions. The cards may now be pressed flat together, but the moment the pressure is removed this double arch, or "bridge," will again appear between them, supplying ample guidance for the performer to cut or make the pass at that point.

If the noted card is on the top, the process is equally simple. The performer, holding the cards in his left hand, with the thumb across their middle, grips endwise with the thumb and second finger of the right hand the upper half of the pack, and bends the ends of such upper half smartly upwards. The upper half of the pack is thereby rendered concave, the lower remaining flat, as at first. The upper half is now passed below the lower, and, as in the former case, there is between the two halves a cavity, in this case plano-concave, thus (|), serving as a guide to the operator to cut the pack at that point.

To make the "bridge" is easy enough, but to use it dexterously demands a considerable amount of skill. Our young readers may therefore be glad to know that there is a mechanical expedient for the same purpose, which, though in many respects inferior, has the advantage of being much more easily handled. This is known as the "long" card, being a card a shade longer (or wider, as may be preferred) than the rest. It is obvious that however freely the pack may be shuffled, the performer can always cut by feel at this card. Where he desires to cut at some particular card other than the long card itself, he has it placed immediately below the long (or wide) card; when, cutting at that card, the one desired will be the uppermost of the lower packet.

The long card is also available to indicate at what point to make the pass. The card having been found by feel, the little finger is inserted above or below it, as the case may be required, and the pass made at that point.

We now proceed to the description of a few tricks of an elementary character, with and without sleight-of-hand.

TO DISCOVER A CHOSEN CARD.

There are many ways of doing this. One of the simplest is as follows:—

Offer the pack to be shuffled, and then "cut" it into three pretty nearly equal portions. Take the centre portion and begin to deal it, card by card, face upwards upon the table, asking a spectator to note any card he pleases, and to remember at what number it falls. Meanwhile, you yourself take special note of the *first* card, which we will suppose to be the seven of hearts. Having dealt through the packet, you turn it over, place one of the side packets above and the other below it, and invite one of the spectators to cut. This may be done as many times as you please, provided that the pack is re-made: i.e., the lower packet placed upon the upper each time that a cut is made. This done, you take the pack in hand, and inquire of the chooser at what number his card originally stood. He tells you, say, seventh. You tap your nose with your forefinger seven times, and say oracularly, "Seventh! I know your card, sir,* and I will proceed to find it for you." So saying, you begin to deal (laying the cards face upwards) from the top of the pack, watching carefully for the seven of hearts (the original first card). When it appears, calling that card "one," you mentally count onward to seven, for the seventh card will be the one which was thought of. (It is, we will suppose, the queen of spades.) The moment you catch sight of it, you exclaim, "Here it is: the queen of spades. Was not that your card, sir?" If you have been quick enough in naming the card, nine out of ten of the spectators will be persuaded that you did actually know, and were in search of that particular card.

The trick is at best merely a juvenile affair, but if there is a long card† in your pack, you may repeat it in a much more striking manner, and there is just enough difference between the two methods to remove the objections to an *encore*.

As before, you hand the pack to be shuffled. When it is returned, you "cut" it at the long card, placing the lower half on the top. This brings the long card to the bottom. Ask some one to cut the pack into three portions. Pick up either of these two which do *not* contain the long card, remarking,

* This is not strictly truthful. You do not know the card, though you know how to find it; but a conjurer has a well-understood licence as to the veracity of his statements. His whole entertainment is but a series of fibs in action, and no sensible person would therefore expect strict veracity in his verbal assurances. In point of fact, a conjurer's patter very largely consists of fictitious statements.

† This may be actually either a "long" or a "wide" card (see above). The term "long card" is used indiscriminately to signify either.

"I will now repeat the trick in a still more surprising form, for I will find your card blindfold. Will somebody be kind enough to blindfold me." This is done. You deal as before (face downwards) between the other two packets, requesting some one to note a card, and to remember at what number it appears. When you have gone through the packet, you gather the cards together, turn them over, and place the other two packets above and below them, the long card packet uppermost. Ask the chooser at what number his card stood. He replies, "tenth." Invite as many persons as please to cut the pack, each time placing the lower half on the upper. When the pack is returned to you, you yourself cut it, *doing so at the long card*. The card following will be *the first of the heaps dealt*, and the remainder will follow in unbroken order. Taking the cards one by one, you mentally count from one to ten, but must not let the audience perceive that you do so, and the best way to divert their minds from suspecting it is to hold each card face downwards as you remove it, and feel its face with the tips of the fingers. When you reach the tenth card, you must simulate more than ordinary hesitation, finally remarking, "Yes, this is it. To prove that there is no deception, may I ask you to name the card?" "The ace of diamonds," we will suppose, is the reply. "The ace of diamonds!" you exclaim. "I was right. Here it is, you see," turning up the card: "the ace of diamonds."

The trick, as will be seen, is worked by precisely the same means as on the first occasion, but the alteration of the *mise-en-scène* has given it a different aspect, and a spectator who was even acquainted with the trick in its first form may be nonplussed by it in its second.

**TWO HEAPS OF CARDS HAVING BEEN LAID ON THE TABLE, TO PREDICT
WHICH OF THEM WILL BE CHOSEN BY THE AUDIENCE.**

Here, again, two methods may be employed, one involving the use of sleight-of-hand, the other without it. In the latter case the operator places, face downwards, two heaps upon the table, one consisting of a given number of cards, say seven, the other of the four cards of the corresponding denomination. He then asks some one, say a lady, to choose, mentally, one of the two heaps; then, gazing fixedly into her eyes, says:—"Ladies and gentlemen, you have heard of thought-reading, I dare say. I am going to give you a proof that I can read this lady's thoughts by showing you that I know which of those two heaps she has chosen. To avoid any possibility of deception, I will write it down." He writes in pencil on a card, "The lady has chosen the 'seven' heap," places it in an envelope, and asks some member of the audience to take charge of it.* "Now then," he continues, "I have done my part. Will you be kind enough to show the company which heap you mentally selected?" The lady points out the heap on which she fixed her mind, which may, of course, be either the one or the other. If she has chosen the heap of seven cards, the performer says, spreading the two heaps, still face downwards: "You will observe, ladies and gentlemen, that this heap consists of seven cards, and the other of four only. The lady has chosen the heap of seven. Will the gentleman who holds the envelope open it, and read out what is enclosed?" This is done accordingly, and the answer found correct.

In the case of the heap of four cards being selected, the operator turns them both face upwards, but only spreading the four sevens, as it is now desirable to prevent the audience from noticing that the other heap consists of seven cards. "You will observe that the two heaps are differently constituted. This one, which

* This is, of course, mere surplusage, but much of the dramatic effect of a trick depends upon these little minute details. The performer might announce verbally, "The lady has selected the 'seven' heap," but it would not be nearly so effective.

the lady has chosen, consists of the four sevens; the other is a handful of mixed cards"—which he shows them to be. The envelope is opened, and the result is found to have been correctly predicted.

Now for the sleight-of-hand method of performing the same trick, or rather, a trick like it in effect, though worked in a wholly different way, and therefore just the thing to use as an *encore*. The pack having been duly shuffled,* the performer counts off from the top and lays on the table two heaps, each consisting of six cards—not, however, allowing the audience to see the precise number. He then boldly announces, "I have here two heaps of cards. One contains six, the other seven.† I want some one to choose one of them. You will, sir? Thank you. You have made your selection—kindly look me in the face for one moment. Good! I have it; I know which heap you have chosen." He writes down (say), "The gentleman has chosen the 'seven' heap," and hands the memorandum to some other person. "Now, sir, will you point out to the company which heap you chose." This is done. "I knew it. Will you count the cards for yourself?" The performer picks up the cards with his right hand, in which he has meanwhile palmed a card from the top of the pack, thereby adding such card to the six. "And you, sir, will you read out what I have written inside that envelope?" This is done, and the answer found to tally with the number of cards in the heap.

He replaces the cards on the table, in so doing again palming off the odd card, and invites some one else to choose between the two heaps. "Stop a bit," he says; "even before you make your choice I can tell you which you will choose. This time you will choose the 'six' heap."

The chances are ten to one that the person thus challenged, having seen on the last occasion that the heap then chosen contained "seven" cards, will endeavour to prove the performer wrong by choosing that same heap, and will announce his choice accordingly, but whichever he chooses, it comes to the same thing. "Good!" says the performer coolly. "Count the cards for yourself. You have chosen the 'six' heap. And this other heap, as you see" (here he adds the palmed card to it again), "is the 'seven' heap."

THE NERVE TRICK. A GIVEN CARD HAVING BEEN CHOSEN, TO GIVE THE CHOOSER THE PACK TO HOLD, AND KNOCK THE REST OF THE CARDS OUT OF HIS HAND, LEAVING THAT CHOSEN STARING HIM IN THE FACE.

An easy way of discovering a chosen card is as follows:—Deal *twenty-seven* cards, face upwards, in three heaps of nine each, inviting some person to note any card. The rest of the pack is thrown aside. When the three heaps are complete, inquire in which the chosen card is. Place the other two heaps, still face upwards, upon this. Turn over the cards, and deal again in three heaps, inquiring in which of them the chosen card now is. Again place the other two packets upon this. Once more deal three heaps, and make the inquiry for the third time. Whichever be the heap indicated, the chosen card will be the first (*i.e.*, *lowest*) card of such heap, and the performer, having noted the first card of each of the three, is in position to name with confidence the chosen card.

But this would be a very feeble method of finishing the trick. A better one is as follows: Gather up the cards as before, *i.e.*, placing the other two heaps, face upwards, on the indicated heap, and on these the rest of the pack. Hand

* Cards should frequently be offered to be shuffled when the trick allows it, as the audience thereby gradually acquire a conviction that the so doing makes no difference to the performer, and are the less likely to demand to shuffle when it might be inconvenient to let them do so.

† This is another instance of the poetic licence already referred to.

the pack, still face upwards, to some other person to hold by one end between the fingers and thumb. The exact manner of holding is important. The fingers should project a full inch on the under side of the cards, but the thumb, on the upper side, barely half an inch. Addressing the person who drew, you say: "Let me show you in the first place that I know the card you chose, sir. It was (say) the nine of diamonds. That is correct, I think?" The fact is admitted. "But I will do more. The nine of diamonds is somewhere in the pack that gentleman is holding. May I trouble you, sir, to hold the cards straight out, that all may see them? Nine of diamonds, appear!" So saying, you strike the free end of the pack a sharp but not too heavy downward blow with the tips of your fingers. All but the undermost card will fall to the ground, but that card (which, it will be remembered, is the chosen one) will remain face upwards in the hand, being retained by the greater friction of the fingers.

If the performer is expert in sleight-of-hand he may enhance the effect of the trick by palming off the card as soon as he has ascertained and brought it to the top of the pack, and handing the remaining cards to be shuffled, replacing it as soon as they are returned. The shuffle seems to render it impossible that the card should occupy any particular position in the pack, and its remaining alone in the hand is therefore the more astonishing.

The revelation of the chosen card in the particular manner described is, of course, optional. Having once discovered and brought it to the top of the pack, the performer may produce it in any manner he pleases. Instead of striking the pack out of the hand of another person, he may take it vertically in his own hand, with thumb in front and the fingers (privately moistened a little) on the back. A smart downward jerk will cause all the cards to fall except the top card, which was the one chosen.

TO PASS A CHOSEN CARD THROUGH A HAT.

The pack having been duly shuffled, invite some one to draw a card, allowing him free choice. When the card is replaced, bring it to the top by the pass, palm it off, and hand the rest to be shuffled. Meanwhile, borrow a hat. When obtained, take it in the hand which holds the card, in such manner that the thumb shall be outside, grasping the brim; the rest of the hand, in which the card is concealed, lying flat against the leather lining. Ask the owner whether there are any holes in his hat, at the same time pretending to examine it on all sides. In so doing you turn the interior to the audience, and enable them to see for themselves, without your verbally calling attention to the fact, that it is empty. Make some such remark as, "Well, it seems a good honest sort of hat; I will place it here on the table, and ask you all to keep one eye upon it." So saying, you place it mouth down upon the table. As you do so, the fingers work the card a little further into the hat, and when you put it down the card falls face upwards beneath it. A little practice is needed for this, but the knack is soon acquired.

This done, take the pack from the person who has shuffled, and say, addressing the spectator who drew the card, "I shall now make your card pass from the pack, and under that hat on the table. To prove that I perform my undertaking, will you please say what the card was?" The card is named. You make any appropriate gesture with the pack above the hat, pronouncing any mystic formula you please, and when the hat is lifted, the card is found lying beneath it, having ostensibly passed through the crown.

This trick, which demands only very moderate skill in sleight-of-hand, will be found very useful in the event of failing to force a desired card. The performer performs this feat with the card actually drawn, and then makes a fresh attempt to force the card on some more accommodating person.

A FEAT OF DIVINATION. OF ELEVEN CARDS, PLACED IN A ROW ON THE TABLE, TO SAY HOW MANY HAVE BEEN REMOVED FROM THE ONE END TO THE OTHER.

Pick out from the pack the plain cards and knave of any suit you please (or of mixed suits); and lay them face downwards on the table in the following order:—

Knave, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1.

(The knave, it should be stated, stands for 0.) You invite the company, during your absence from the room, to transfer any number of cards they please from the right hand end of the row to the left, in other respects preserving their order. You undertake, on your return, to tell them how many have been moved.

When you are recalled, you look fixedly at the row of cards. After due consideration, you say: "I have undertaken to tell you how many cards you have moved, but I will do much more than that, I will turn up a card which shall strictly give the required information." So saying, you turn up *the first card* of the amended row, which will infallibly show the number moved. Thus, suppose that five cards have been shifted, the new order of the cards will be as under:—

[5], 4, 3, 2, 1, knave, 10, 9, 8, 7, 6.

This is a trick which, unlike most others, will bear repetition. You might replace the five cards shifted at the opposite end of the row, but in such case you would again have to turn up the *first* card, and the audience would not fail to notice that you did so, and to guess that that was in some way the "key" card. But there is no need to do this; all you have to do is to add the *number of the card* (in this case 5) to its *position in the row* (1). The total, 6, will give you the position of the next "key" card. Turning down the exposed card, but without otherwise disturbing the row, you invite the audience to "try again;" they do so, moving, let us suppose, four cards. The row will now be as under:—

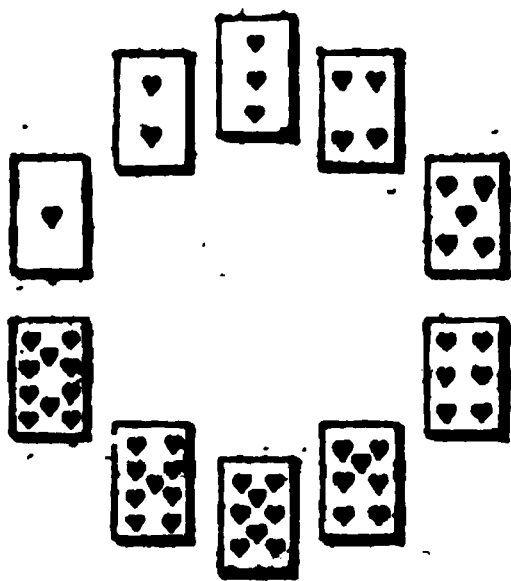
9, 8, 7, 6, 5, [4], 3, 2, 1, knave, 10;

and, as will be seen, the *sixth* card indicates the number moved. The number of the next indicating card will be $4 + 6 = 10$. Thus if three cards be next removed, the row will be as under:—

1, knave, 10, 9, 8, 7, 6, 5, 4, [3], 2.

and the indicating card, the three, will stand tenth.

The experiment may be repeated as often as you please, the various positions which the indicating card assumes puzzling the spectators more and more at each fresh trial.



MYSTIC CIRCLE.

THE MYSTIC CIRCLE. TO DISCOVER A CARD THOUGHT OF.

Arrange the first ten cards of any suit in the manner shown in the annexed diagram. Request some one present to think of one of the exposed cards and to touch some other card. Mentally add the value of the card he touches to the number of cards exposed, namely, ten; and then ask him to count that sum backwards, beginning at the card touched, and reckoning that card as the number thought of.

For example, suppose the *three* was the card

thought of and the six was the card touched: six added to ten makes sixteen; then commencing with three at the sixth card, and counting up to sixteen on the cards backwards—that is, calling the six three, the five four, the four five, the three six, the two seven, and so on up to sixteen—it will be found that the counting will end on the three, the card thought of.

The above trick is frequently performed with a watch, but it is more effective with cards, as being visible to a greater number.

TO PICK OUT A CHOSEN CARD FROM UNDER A HANDKERCHIEF.

There are two ways of performing this trick. For the first method a long card is necessary, but the second may be employed with any pack, being purely dependent upon sleight-of-hand.

In the first case, the performer forces the long card, allowing the drawer himself to replace it, and to shuffle as freely as he pleases. The pack is then placed on the table, and covered with a borrowed handkerchief. The performer inserts his hand beneath, and by the projection of its edge is readily enabled to identify and produce the card.

In the event of a failure to force the desired card, or of its being undesirable to do so from the fact that the long card has already been used in some previous trick, the performer may allow any other card to be drawn, having it replaced, when returned, *under* the long card. The pack may then be offered to be shuffled (as most people shuffle) with very little fear of the two cards being divided. If, however, the operator does not care to run the risk of this, he may offer the cards to be “cut” instead. Under cover of the handkerchief, he himself simply cuts at the long card, when that chosen will be on the top of the lower heap.*

The sleight-of-hand method is, in its way, equally simple, but demands a certain amount of address on the part of the performer. He allows a card to be freely chosen; and when returned, brings it to the top by the “pass,” and palms it off, immediately handing the pack to be shuffled. When it is returned and covered by the handkerchief, he introduces his hand, still holding the palmed card, beneath, and after more or less groping (for the sake of effect) among the cards, produces it.

While handing the pack to be shuffled, it is easy to “get sight” of the card; which done, he may produce a further effect by “reading” it with the tips of the fingers.

MISCELLANEOUS TRICKS.

PASSING from card tricks to those performed with other objects, we find that the power of “palming,” or holding an article in the hand unknown to the spectator, is again a first requirement: indeed, is the foundation of half the mysteries of magic. The method of palming varies according to the object to be dealt with. An orange, egg, or ball, or a coin of large size, such as a half-crown, is held in the palm of the hand, and retained by the pressure of the fleshy portions which surround it. This is “palming” proper; but the term is also applied to other methods of holding an object. Thus, a small ball or marble is generally held

* The chances are much against any given pair of cards in a pack being divided by a casual shuffle. Where a “wide” card is used, the two cards are still less likely to be separated, for the projection of the wide card tends to prevent the next following from being separated from it.

between the roots of the second and third fingers, or by a slight contraction of the third and fourth fingers. A coin may be held between two fingers, or against the middle joint of either of the fingers, such finger being bent slightly to retain it.

But there is a second sense in which the term "palming" is used: viz., it not only indicates the holding an article in concealment as above, but also the placing it in that position; and one of the first tasks of the neophyte must be to acquire the power of doing this easily and rapidly in the very act of (apparently) transferring the article from the one hand to the other. This is done by pressing it with the second and third fingers into the palm. To the eye of the spectator, the object is transferred (say) from the right hand to the left; but in reality it remains concealed in the hand in which it was first seen, having been "palmed" in the moment of supposed transit.

Another very useful sleight is known as *The "Tourniquet,"* or "*French drop.*" Palming, as above described, is generally made use of in passing an article from the right hand to the left. The "tourniquet" forms a useful variation, as being not only effected by a different motion of the hand, but as being used mostly in the reverse direction: viz., from the *left* hand to the *right*. It is worked as follows: The article to be dealt with, say a coin, is exhibited breadth-wise between the thumb and second finger of the left hand. Thence it is apparently taken by the right hand, the thumb of such hand passing below and the fingers above the coin, and apparently closing upon it in so doing. Nothing could look fairer; but in reality, at the very moment when the fingers of the right hand appear to grasp the coin, it is allowed to fall into the hollow of the left, the right continuing its movement in an upward direction as if containing it, closely followed by the eyes of the performer, which, as we have already remarked, inevitably lead those of the audience in the same direction. Meanwhile, the left hand gently closes on the coin just sufficiently to retain it, and slowly falls by the performer's side, dropping it into his pocket or behind his table.

Exchanges.—A very large proportion of the wonders of magic rest upon *substitution*. A half-crown, for instance, is borrowed, and is made to appear in some circumstances utterly irreconcilable with the fact that it has, ostensibly, remained up to the last moment in full view of the spectators. This is effected by the adroit substitution of a second coin, to be left in view, while the borrowed one is dealt with as may be necessary. The modes of effecting the necessary "change" will offer no difficulty, so soon as palming is once thoroughly mastered. Thus the substitute coin may be lying hidden in the left hand; the borrowed coin is shown in the right hand, and being thence apparently transferred to the left, is palmed in transit, the substitute being exhibited in its stead.

Another method is to hold both coins in the right hand, the borrowed coin in full view between the tips of the first finger and thumb, the substitute concealed against the second and third joints of the middle finger, which is slightly bent in order to hold it. In the act of apparently transferring the visible coin, the concealed coin is let fall into the left hand, while the borrowed one takes the place of this latter in the right hand. The movement is somewhat difficult to explain clearly in writing, but a few experiments, coins in hand, will make it intelligible enough.

Among the special paraphernalia of the conjurer, we must not omit to mention:—

The Magic Wand.—The use of the wand is generally regarded by outsiders as a professional affectation; but such is by no means the case. The wand is not only the accepted symbol of the magician's power, but serves as a pretext for a variety of movements, which without it would seem unnatural, and therefore

suspicious. When an article is palmed, the holding of the wand in the same hand, accounts for any incidental contraction of the fingers, and aids in masking the hidden article. When the hands are otherwise empty, the wand occupies them and is a material help to ease and naturalness of demeanour. Further, an occasional journey to the performer's table, to fetch or lay down the wand, is of the greatest possible value, as enabling him to turn his back upon the audience, and so gain the opportunity to effect many changes, etc., which could not conveniently be made while face to face with the spectators.

The wand should be about sixteen inches in length, and five-eighths of an inch in diameter. It may be tipped with ebony or ivory, but the plainer it is in other respects, the better.

For rapidly and secretly procuring or getting rid of necessary articles, the professional conjurer is provided with a number of special *Pockets*.

The exact shape and position of these vary according to the fancy of the performer. Small semi-circular pockets, known as *pochettes*, on the outside of the leg of each trouser, just behind the thigh, will be found very useful; also a deep pocket, known as the *profonde*, inside the tail of the coat, for dropping articles therein. These should be so arranged that their mouths are just at the level of the knuckles as the hand hangs by the performer's side. The inside of the lower edge of the waistcoat is also used as a receptacle for small objects. To adapt it the better for this purpose, an elastic band is sewn inside the hem of the vest, causing it to cling closely to the person. An article placed in this position is said to be "vested."

Of even greater importance, where the performer aspires to give a regular "show," is—

The Conjurer's Table.—Many of the stock tricks of the conjurer (for instance, that of the "inexhaustible hat") depend upon the existence of a secret receptacle, unknown to the spectators, for rapidly getting rid of or producing articles of considerable size. This is obtained by a special arrangement of the performer's table, which has a secret shelf behind it, on the further side from the audience. On this shelf, known as the *servante*, repose the cannon-balls, lanterns, loaves of bread, etc., which are to be produced from the innocent-looking hat. On this also rests a padded box, known as the "drop-box," for noiselessly receiving any article which the performer may desire suddenly and silently to get rid of. In order to facilitate the picking up or laying down of articles without any tell-tale bending of the body, the *servante* is fixed a little above the level of the tips of the performer's fingers as they hang by his side, the surface of the table itself being about five or six times higher than this.

Where a proper conjurer's table is not available, it becomes necessary to improvise one. A drawer pulled out a few inches will make a rough-and-ready substitute for a *servante*. Another method is to select a tolerably high table with the ordinary hanging cover, and to gather up and secure with pins a certain portion of such cover on the rear side of the table, so as to form a wide shallow bag for the reception of necessary objects. A still better plan for the amateur is to place on the ordinary table a writing-desk or shallow box (professedly to render the articles used more conspicuous by greater elevation). The top of this desk will then represent the surface of the table; the space behind it, which should be of six or eight inches in width, taking the place of the *servante*. If the performer uses a box for parking his magical apparatus, it is well to have it of such a size and shape as to suit the above purpose. A soft cloth cap, with a folded silk pocket-handkerchief laid in the crown, will form a very good substitute for the "drop-box."

Having disposed of these needful preliminaries, we proceed to the description of actual tricks. We must, however, premise, and the fact cannot be

too strongly impressed upon the neophyte that a conjuring trick is just what the performer makes it. The bare mechanical effect produced may be described in a dozen lines, but this is, to the finished illusion, what an air picked out with one finger on the piano is to the same melody executed by an accomplished musician.

We will proceed to practically illustrate our meaning, purposely selecting two good old-fashioned tricks, familiar to the most juvenile reader; we mean

THE CONE AND BALL-BOX.

The ball-box is a piece of apparatus procurable at almost any toy-shop, from a shilling upwards. It consists of a little vase and lid, both made of boxwood, and containing a red ball, which exactly fits the interior. The secret lies in the lid, which contains a hollow shell, coloured in imitation of the upper half of the ball. The lid may be lifted off with or without this portion. If lifted off without, the false half-ball remains on the top of the vase, and represents to the eye the solid ball.

The juvenile or "anyhow" method of exhibiting the trick may be described as follows:—The performer opens the box and takes out the ball. "You see this ball, and you see me put it in my pocket and shut up the box again. Now I am going to make it go back into the box." He opens the box, leaving the shell on. "There it is, you see. Now I will make it come back into my pocket again." He again takes off the lid, this time *with* the shell. The vase is empty, and he produces the ball from his pocket. "Dear me!" says the spectator, mentally adding, "Not much in that."

Now for the same trick as an expert would perform it. His first endeavour (still to pursue our musical simile) would be to "put a bass to it"—i.e., to make the appearance or disappearance of the ball harmonise with some corresponding effect in a different quarter. This might be managed in a score of ways, but we have given the preference to the use of the "cone," as being as simple in construction, and nearly as widely known, as the ball-box itself. The cone is a block of polished boxwood, circular in form, and tapering upwards from its base to a blunt rounded top. It is made in various sizes, but the most appropriate to work with our ball-box would be about four inches in height, with a diameter of (say) one inch and three-quarters at the base, and one inch and a half across the top. A thin shell of boxwood fits loosely upon the solid cone, and exactly resembles it in external appearance, so as not to be distinguishable by the eye from the solid block itself. A piece of white cartridge-paper, rolled into a sugar-loaf shape, and of such a size as to go easily over the cone and shell, completes the apparatus.

We prepare for the trick by placing the "half-ball" of the ball-box on the *servante*, and the other articles on the table. This done, we are ready to begin.

"I am about to show you, ladies and gentlemen, a feat of dexterity of a very extraordinary character. Let me call your attention, in the first place, to this solid block of wood and this elegant little vase. Pray observe that there is 'no deception' about them. Here is the little vase, here is a ball fitting exactly within it, and here is the little cover for the vase. Pray examine each and all of them." (Here we hand them for examination, taking care, however, to hand all three to different persons, as the cover, owing to the absence of the intermediate shell-ball, will not fit accurately on the vase.)

"Here I have" (we show the cone with the shell on it) "a solid block of wood; and here is a simple piece of paper, which forms a cover for it." (Suiting the action to the word, we slip the paper tube over the cone, then let the cone fall

out again on the table, but maintain a gentle pressure on the paper, so as to retain the hollow shell within it. We then lay down the paper tube, the closed end towards the spectators, and hand this solid block for examination. When returned, we replace it in full view, and cover it with a borrowed hat. On the crown of the hat we place the red ball, covering the latter with the paper sugar-loaf, still containing the hollow cone. The ball-box we place at a little distance, and close the lid but, before so doing, secretly drop the hand containing the lid behind the table, and over the shell-ball, which thereby is made to resume its proper position within the lid. To all appearance, the vase is empty.)

"We now have, ladies and gentlemen, the cone beneath the hat, the ball on the top of the hat, covered by this piece of paper" (we lift each, and show that the facts are correctly stated), "and the ball-box empty. Now for a magical transposition. First and foremost, I command the ball to pass from under this paper cover, and go back into the box. It has obeyed, you see" (lifting the lid of the box without the shell-ball, which is taken to be the solid ball). "Now I shall order the cone to pass upwards through the crown of the hat, and take the place of the ball." (We lift the paper sugar-loaf, taking it daintily by the extreme point. The hollow shell is left on the table, covering the ball, and is taken for the solid cone.) "But perhaps I was too quick for you. We will reverse the operation, and this time do it as slowly as possible. Ball, go back under the paper. Pass!" (We lift the lid of the box *with* the false ball, and show the vase again empty.) "Cone, go down again beneath the hat." (This time we lift the paper cover with a gentle pressure of the fingers, thereby retaining the shell cone within it, and disclosing the ball. Then, lifting the hat, we show the solid cone beneath; and while the general attention is called to this, lower the hand holding the paper cover for a moment behind the table, and, slightly relaxing the pressure of the fingers, let fall the hollow shell into the "drop-box," after which the paper cover may be freely offered for examination. The shell-ball in the lid of the ball-box may be got rid of in the same manner.)

If the performer is proficient in sleight-of-hand, he may further heighten the effect of the trick by the use of a duplicate ball, which in the first instance will be laid, unknown to the spectators, on the *servante*. When about to pass the ball from under the paper cover into the ball vase, he will secretly "palm" this second ball, and passing the hand gently up the paper cover, produce it at the finger-tips. Then, apparently transferring it from the right hand to the left, he will again palm it in the right, and ordering it to pass from the left hand (which apparently contains it) to the box, open such hand, and show it empty, meanwhile letting fall the ball from the hand which really holds it into the drop-box. This intermediate production and disappearance of the ball is a great addition to the trick. It will further be observed that in the trick as above described, every part of the apparatus has ostensibly been inspected by the company, who, even if acquainted with the older methods, are thereby persuaded that they have not been used.

THE HANDKERCHIEF BURNT AND RESTORED.

This is a capital sleight-of-hand trick for the drawing-room. It requires no apparatus, causes a good deal of fun (as, indeed, do all tricks involving the apparent destruction of other people's property), and, neatly performed, produces a really striking effect.

The only preparation needful is to procure a little square piece of cambric, six inches each way. Taking it by the centre, draw it through the fingers, and place it horizontally, in the shape thus produced, just under the front of the

vest on the left-hand side. A lighted candle should be placed upon a table at some little distance from the spectators.*

These arrangements having been duly made, the performer advances to the audience, carelessly showing by his gestures that he is empty-handed, and asks for the loan of a lady's handkerchief. He next asks whether he may mark it. The owner readily agrees, but when he adds that he finds the most satisfactory method of marking it is to burn a little hole in the article, she may probably regret her consent.

Taking the handkerchief by its centre with the right hand, and letting its corners fall on either side, he takes it thence into the left hand, nipping the centre portion between the thumb and first finger, the remainder passing down through the hand. Approaching the candle, he advances the centre to the flame, but pretends to hear a remark that he has changed the handkerchief. "Changed the handkerchief!" he exclaims. "Certainly not. Pray satisfy yourselves that I have done nothing of the kind." He advances to the owner, at the same time spreading the handkerchief, and holding it apronwise, by two of its corners, in front of him. Each corner is held between the first and second fingers of the hand, and the upper edge of the handkerchief comes a shade above the lower edge of the vest. In this position it is easy, under cover of the handkerchief, to get down into the left hand with the first finger and thumb the little piece of cambric. Again the performer takes the handkerchief with the right hand by the centre, and thence transfers it to the left, where its centre lies exactly level with the centre of the piece of cambric. He now draws this latter (which the spectators take to be the centre of the handkerchief) out of the hand from one and a half to two inches, then, advancing to the candle, sets fire to it, and, returning to the audience, shows that there is "no deception." To all appearance a large hole is being burned in the centre of the handkerchief. A moment later he blows it out, and, after a due amount of by-play, turns the hand over, letting the corners fall in the opposite direction, then touches the handkerchief with the wand, or simply rubs it between the hands, and a moment later shows it restored. The reverse movement above described leaves the charred cambric in the hand beneath the handkerchief, where it can easily remain palmed until an opportunity offers of getting rid of it.

Another form of restored handkerchief trick may be performed with the aid of the canister or globe described at pages 918—919. In this case the borrowed handkerchief must be secretly exchanged for a substitute (this may be done under the performer's vest during his brief journey to his table). The genuine handkerchief is then secretly placed in one of the compartments of the restoring apparatus, and the dummy, after having been torn, burnt, and otherwise maltreated openly, in the other. From this point the restoration is easy.

THE COIN MELTED AND RESTORED.

Place a lighted candle upon the table. Borrow from some one of the audience a half-crown, and let it be marked before it is handed in. (N.B.—In performing tricks with coins and other articles of every-day use, it is always advisable to borrow from the spectators, as the audience are then convinced that the articles used are not specially prepared.) Having received the half-crown, look intently at it, rub it smartly on both sides, place it on the table

* In all drawing-room conjuring, the performer should take care to have the whole of his audience *facing* him, the portion of the room behind him being quite clear of spectators. He should have a table whereon to place the objects used in his performance, and there should be a clear interval of at least two or three paces between the table and the front row of spectators. Short as the transit from the one to the other is, it will be found invaluable for covering a host of necessary operations.

beside the candlestick, and rub the hands briskly together—all this by way of by-play—keeping up in the meantime some suitable discourse on the nature of metals, the heat required to melt them, the necessity of developing mesmeric power, and so on. Take up the coin in the right hand, moving it towards the left, as though to place it therein, but instead, during its passage, palm it in the right hand. The coin being now professedly in the left hand, close that hand accordingly, as though it really held the coin. Work the fingers about as if to further mesmerise the coin, and at the same time take the candlestick in the right hand; this action, while helping the performer the more easily to keep the coin palmed in a natural manner, will make it appear to the audience that it is impossible for the coin to have been kept in that hand. The next motion is to hold the left hand, still closed, over the flame of the candle, and to work the fingers as if allowing the slowly-melting coin to ooze out by degrees. In the course of the talk, or “patter,” call attention at this point to the coin as in the process of being passed into the candle, open the left hand, and show that the coin is now no longer therein. After a short lapse of time, to allow of the molten silver becoming thoroughly absorbed in the wax or tallow of the candle, put the candlestick on the table, and with the fingers of the right hand (in which, remember, the coin remains palmed) make believe to draw the melted coin out of the candle through the wick, transferring it bit by bit into the palm of the left hand. During the execution of this movement, bring the palmed coin immediately above the hollow of the left hand, and secretly let it fall therein. Take the fingers of the right hand from the wick of the candle, pretend to drop from them the remainder of the recovered metal into the palm of the left hand, make believe to manipulate it into its original shape by rubbing it gently with the fingers, as if still hot and difficult to hold, toss it from hand to hand in order the more rapidly to cool it, and finally return it to the spectator from whom it was borrowed, with a request that he will identify his “mark.”

This is one of the simplest of sleight-of-hand tricks with coins, but as an introduction to a series of such tricks in a performance of parlour magic, it will be found to be very effective, and will, if shown in a lively manner, with an accompaniment of appropriate “patter,” never fail to elicit a liberal meed of applause and admiration.

THE VANISHING HALFPENNY.

For the performance of this feat a little piece of apparatus is necessary. It consists of a little round wooden box like an exaggerated pill-box, and procurable at any conjuring depôt for sixpence. It is one inch deep, neatly turned and polished, and of such diameter internally as to exactly admit a halfpenny lying flat. The fit is so good, that if the box is shaken laterally there is no sound, though if it be shaken up and down the coin rattles freely within. The top and bottom, internally, are neatly lined with bright red paper. The box has no opening save the ordinary lid, but it has the curious property that if a borrowed halfpenny be placed in it, it will, at the command of the magician, disappear; returning in the same way when he chooses to recall it.

So, at least, says the magician, but he is not quite truthful in two particulars. The halfpenny that is placed in the box is not the borrowed coin, but another, having one side covered with red paper, exactly like that which lines the bottom of the box. Secondly, the coin never leaves the box, although it appears to do so, but remains there throughout the trick.

The performer, in the first place, hands box and lid for examination, holding meanwhile the prepared halfpenny palmed in his right hand. Having borrowed a halfpenny (duly marked, that it may be known again), he deftly “changes” it for this latter, and holding *this* coin upright between his finger and thumb,

with the papered side towards himself, places it unmistakably in the box, but in such manner that it shall fall *with the papered side upwards*. He then closes the box, and touching the lid with his wand, orders the coin to depart. He shakes the box, to prove that it has done so. As he takes care to shake it laterally, there is no sound. The coin has evidently departed; but to make assurance doubly sure, he opens the box, and shows the interior. The paper-covered surface of the coin is seen, and is naturally taken to be the bottom of the box.

The coin has departed, but where is it? This question the performer answers by thrusting his hand (in which the borrowed coin remains palmed) into some gentleman's waistcoat pocket, and producing it therefrom. Or he may in the first instance desire it to pass to some convenient spot, say beneath a candle-stick on his table, and produce it from thence.

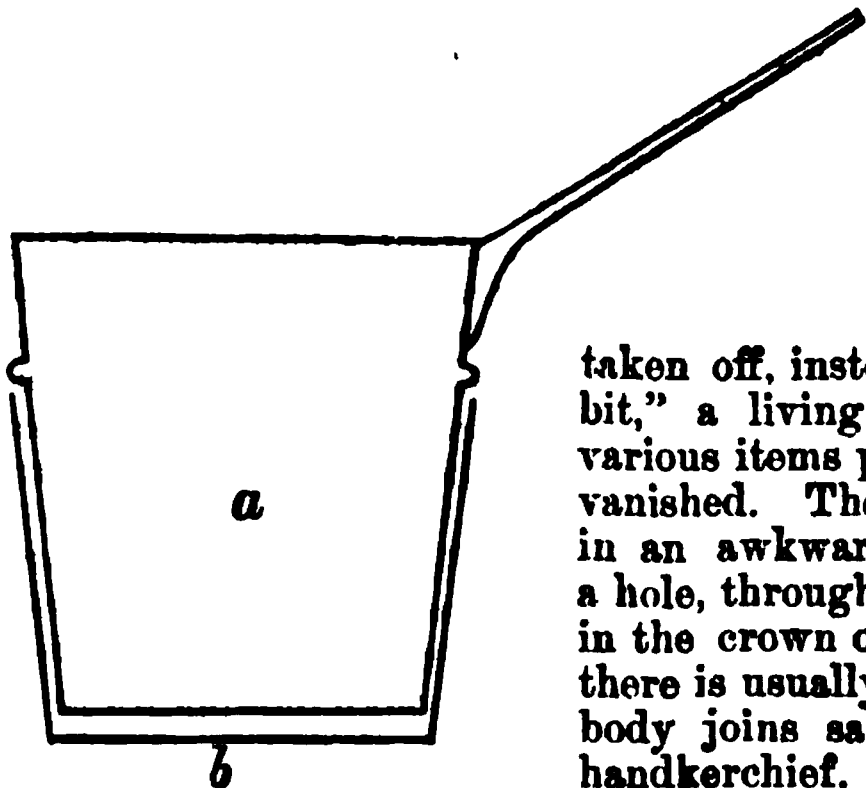
But the trick is not yet over. The performer has still to pass the coin back again into the box, and to do this neatly a little sleight-of-hand will be necessary. He closes the box, and shakes it laterally as before. Nothing there! Then showing the borrowed coin between the thumb and first and second fingers of the right hand, he apparently transfers it to the left, really palming it in transit in the right. Then holding the closed left hand over the box, he says energetically, "Pass!"—making a slight downward sweep of the arm, and at the same time opening the hand, which is seen empty. Again he shakes the box, but this time up and down. The coin within rattles merrily. Opening the box, he pours it out into the palm of the left hand, letting it fall (as it naturally will if the distance be not too great) with the prepared side *undermost*. From the left hand he (apparently) takes the coin in the right, but really leaves it in the palm of the left hand, and shows in its place the marked coin, which remained in the right hand.

THE WELSH RABBIT AND THE DAMAGED HAT.

This is an illusion of a comic character, and produces never-failing laughter among the juveniles.

The performer brings forward a saucepan, to all appearance of a perfectly commonplace character. Into this are poured cheese, mustard, pepper, and other

more or less appropriate ingredients. A fire is made in a gentleman's hat by setting light to a borrowed pocket-handkerchief therein. The saucepan is held over the flames for a few moments, when the cookery is declared to be completed; but when the lid is again



THE SAUCEPAN.

taken off, instead of the anticipated "Welsh rare-bit," a living rabbit makes his appearance, the various items previously inserted having completely vanished. The performer, however, finds himself in an awkward position, for the flames have burnt a hole, through which he pensively pokes his finger, in the crown of the borrowed hat. At this point there is usually sarcastic applause, in which everybody joins save the owners of the hat and the handkerchief. The performer apologises, and offers to hand back the articles in their damaged condition, but the offer is declined. Ultimately, by

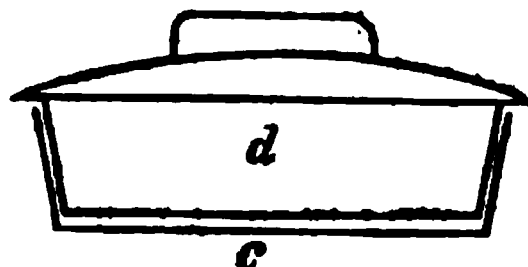
magical means, he restores both hat and handkerchief, and hands them, perfect as at first, to their respective owners.

The saucepan used is of block tin, and of a capacity to hold four or five pints. It has a raised bead running all round it, at about two inches from its upper edge. With this exception, the saucepan proper, *a* (see sectional view, annexed), has no peculiarity, but it has an outer sheath or covering, *b*, fitting easily over its lower part, and just reaching the above-mentioned bead, which masks its upper edge. A shallow tin pan, *c*, fits easily within the saucepan, the lid, *d*, fitting tightly within *c*.

The apparatus is prepared for use by placing a small handkerchief or piece of cambric, slightly moistened with spirits of wine, within *b*, and replacing *b* on *a*. A small rabbit, kitten, or guinea-pig is then placed in *a*, and on the top of this the tray *c* is placed in position, and fastened. In the best made saucepans *c* is held fast to *a* by means of what is termed a "bayonet catch" on either side, a very slight turn from right to left releasing it.

The performer comes forward with the saucepan in his right hand, the two first fingers pressing on the upper part of *b*, and thereby holding it in position, while the lid *d* is carried separately in the other hand. The apparatus is then placed carefully on the table till wanted, the lid being allowed to rest lightly across the top of the saucepan, so as to prevent any one from seeing inside, and so discovering that the internal does not correspond to the external measurement.

The performer having announced that he is about to teach the company to prepare a Welsh rabbit, requests the aid of some young gentleman as assistant cook. He at the same time borrows three white handkerchiefs and a gentleman's hat. With two of the handkerchiefs he manufactures an extempore cap and apron for his assistant and tosses the third into the hat till wanted. He then begins a burlesque lecture on cookery, and finally, taking some cheese, mustard, pepper, etc., chops up all on a plate together and pours the mess into the saucepan; taking care, however, to hold the latter high, so that no one can perceive that the ingredients remain in the tray, *c*, instead of going to the bottom. Occasionally a little candle-grease is added by way of seasoning. The lid is put on. Next arises the question of "fire." The professor requests his assistant to go and fetch the kitchen stove, but this proving impracticable, he remarks that a stove-pipe hat, as the Americans call it, will do as well. He proceeds to try how the saucepan fits the hat, and in so doing leaves *b* within it. He then asks whether any gentleman present has such a thing as a scuttle of coals about him. This not being forthcoming, he is for a moment at a loss, but glancing into the hat, a thought strikes him. He takes out the prepared piece of cambric, which everyone takes to be the third borrowed handkerchief, and remarking that he would rather not have done it, but that there is really no help for it, he sets light to it and drops it back again, a blaze instantly rising and threatening the hat with destruction, though the tin, *b*, protects it from actual injury. The saucepan is waved about over the flames for a minute or so (not longer, or the hat would suffer): then, with the remark, "I should think it was about done now," the performer brings the saucepan down into the hat, thereby extinguishing the flames, and instantly brings it out again, and the tin *b* with it, and places both on the table, the appearance of the saucepan remaining unaltered. In the act of taking off the lid, he gives it a turn from right to left. This unlocks *c* from *a*, and when the lid *d* is lifted off, *c* (which fits tightly within it) is brought away also, thereby causing the disappearance of the culinary ingredients which were placed in it. Of course the performer does not show the under side of the lid, but claps it down on the table, and draws attention away



THE LID.

from it by tilting the saucepan, when the imprisoned animal makes his appearance. Where a kitten or guinea-pig is used instead of a rabbit, the performer accounts for the unexpected result by supposing that he must have made some slight mistake in the ingredients.

The assistant cook is now dismissed to his place. While the general attention is called to the unexpected result above mentioned, the performer gets privately into his left hand (either from his table, under his vest, or elsewhere) a dummy *finger*, which forms the apparatus for the next phase of the trick. This finger is modelled in wax on a cork body, and is coloured in exact imitation of reality. It is about two inches in length, and from its severed end projects a sharp steel pin. This may be concealed in the hand without difficulty. Under the waistband should be concealed a small cambric handkerchief, burnt into holes, and rolled up tightly, for a purpose which will presently appear.

Before the hilarity produced by the appearance of the rabbit has time to subside, the performer should glance, with a look of alarm, at the hat, which he still holds in his hand. Assuming a discomfited expression, he affects to examine it carefully, first inside, then outside. While examining the crown, he takes the opportunity to introduce the burnt handkerchief above mentioned into the hat, and to insert the borrowed one under the vest in its place. He then says, holding up the burnt handkerchief, "I was afraid I had scorched the handkerchief a little. I let it burn a minute or so too long. I hope you will not mind, madam. And I'm sorry to say I've had a little misfortune with the hat. I can't imagine how it happened. I've performed this trick scores of times, and I never burnt the hat before: at least, not so much as this. It's only a very little hole, though; I can only just get my finger through it." Meanwhile he presses the pin of the dummy finger through the crown from the outside, and taking hold of the pin on the inside with the right hand, moves it about, the effect being exactly as if a living finger was pushed from within through a hole in the crown. This little interlude invariably "brings down the house." The finger must not be shown too long, but almost immediately covered by the left hand, and again palmed, the spectators believing that it has been drawn out from within. The performer apologises for the accident, offers to cover the hole with a postage stamp, and so on; but the owner naturally demands that his property shall be restored intact, and after a little discussion the performer describes some mystic characters with his wand upon the crown of the hat, or goes through any mummerly he thinks appropriate, and finally shows the hat, whole as at first.

The owner of the hat having been pacified, the handkerchief remains to be dealt with. As in the case of the hat, the performer endeavours to induce the proprietor to receive it back in its present condition, but in vain. After apparent reflection, a happy thought strikes him. He leaves the stage, returns with a magic canister and a pistol. He places the burnt handkerchief in the canister, fires at it, and on again removing the lid, the borrowed handkerchief is produced from it, not in the least the worse for its fiery experiences.

The secret of the effect last produced lies in the canister, which is of the construction shown in the accompanying

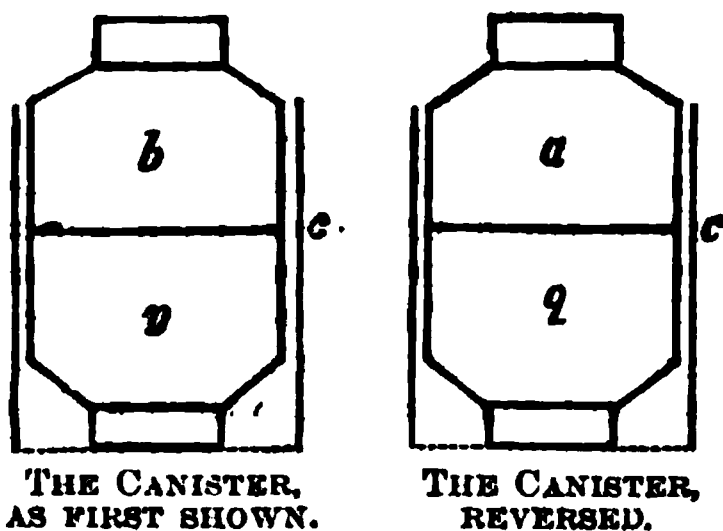
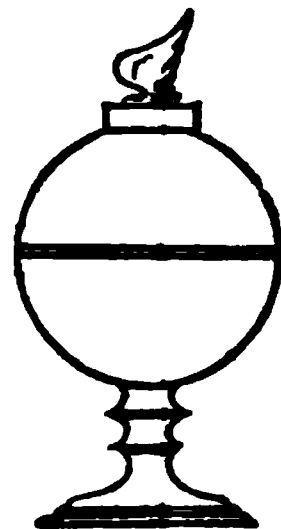


diagram. The actual canister is double-headed, divided into two by a horizontal partition, and working up and down in an outer cylinder, *c*, so that either end may be brought into view at pleasure. When the performer retires to fetch the

canister, he places the genuine handkerchief in *b*, then pushes up *a* in sight, and bringing the canister forward, places the burnt handkerchief openly in *a*, and closes the lid. He then places the canister on the table, but while returning thereto, and while his back is turned to the company, rapidly turns the canister upside down, and pushes *b* into view. When the pistol is fired, and the lid of *b* taken off, the genuine handkerchief is of course found.

A neater but rather more costly apparatus for producing a similar effect is known as the "burning globe." This is a brass vase, of spherical form. It has only one opening externally, but internally is divided into two compartments, the one or the other compartment being brought into coincidence with the external opening, according as the foot of the vase is twisted to the right or to the left. The mode of using the apparatus is the same as with the reversible canister, save that the half turn of the foot to right or left is used in place of the "turn over" movement.



THE
HANDKERCHIEF
GLOBE.

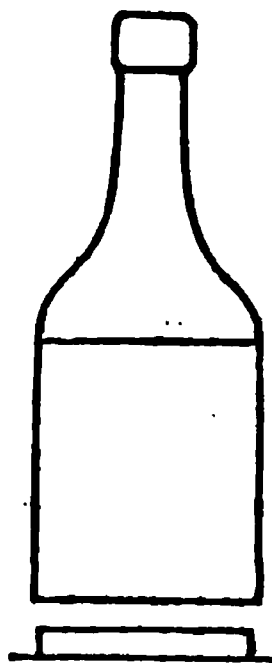
There is no *necessary* connection between the three tricks above described, but we have given them as an example of that *harmonising* of several tricks which we have recommended, and which practically doubles their illusive effect, the one surprise appearing to flow naturally from the other.

THE MAGIC BOTTLE AND MYSTERIOUS FUNNEL.

We have here another illustration of the artistic combination of two or three tricks. The requirements will be as follows:—

1. An oblong wooden or cardboard box, say twelve inches by ten, and seven inches deep, containing bran.

2. A tin bottle, pint size, japanned black in imitation of glass. For liquid-holding purposes, the bottle terminates about an inch below the shoulder, the actual "bottom" being at this point (as shown by cross line in diagram). The bottle has, in addition, a loose bottom (as shown) falling out by its own weight, unless kept in position by the hand which holds the bottle.



THE BRAN
BOTTLE.

3. A tin canister, with shallow lid, japanned to taste, which we shall refer to as canister No. 1.

4. A second canister, No. 2, exactly similar in external appearance, but materially differing in actual construction. It has no bottom; but has a horizontal partition about half an inch down, forming a sort of shallow tray at the top. From this point downwards the canister is open, forming, in truth, a mere shell or cover for the "spring bottle" next described.

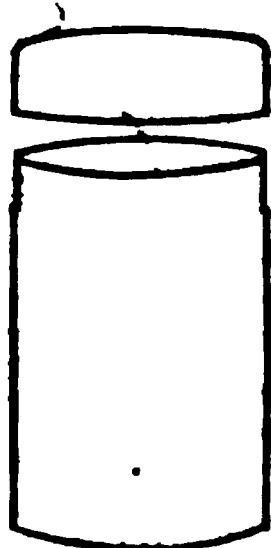
5. A black tin bottle, similar in external appearance to the bran bottle, and of the same internal capacity. The bottle is, however, really made in two parts, the upper portion, duly closed at bottom, being made to slide up and down in the body, which is in fact a mere tube, open at the top but closed at its lower end. A spiral spring within this tube urges the neck portion upwards, unless pressed down by some external force. The upper edge of the tubular portion is bent slightly inwards, to prevent the neck from being forced out altogether. The bottle is thus compressible into about half of its normal length. So compressed, it is placed inside

the lower part of canister No. 2, and secured in that position by a "bayonet catch," a slight turn from right to left releasing it.

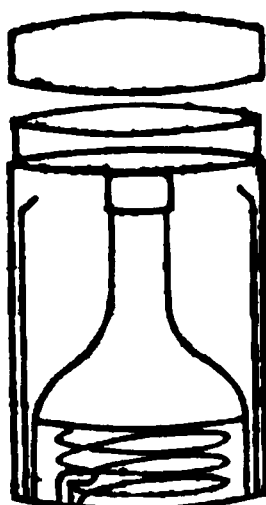
6 and 7. Two cylindrical pasteboard covers, the one fitting easily over the "bran bottle," the other over either of the canisters.

8. A small tray or plate.

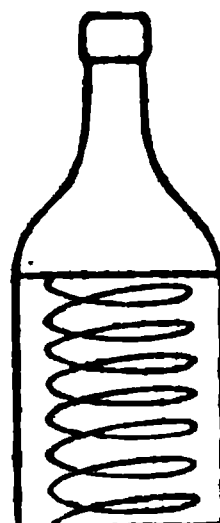
The above complete the requirements so far as the "bottle" portion of the



CANISTER NO. 1.



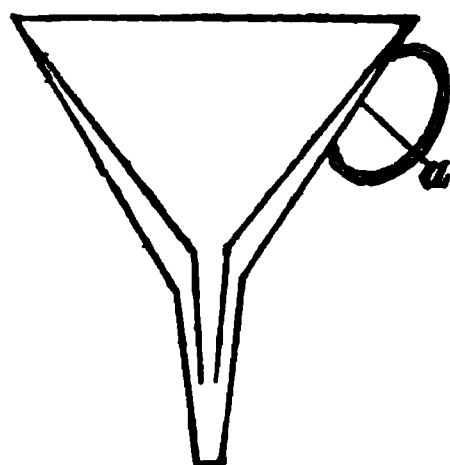
CANISTER NO. 2.



SPRING BOTTLE.

trick is concerned. For the remaining portion of the illusion the performer will need:—

9. A tin funnel, of special construction, being made double, as shown in the figure, the space between the outer and inner surfaces holding about a wine-glassful of liquid. There is a minute hole at *a* for the admission of air.



THE FUNNEL.



THE BRAD-AWL.

10. A specially made brad-awl, so arranged that on pressure, the blade recedes into the handle, but is forced out again by a spiral spring the moment such pressure is removed.

11. A second brad-awl of similar appearance, but of ordinary construction.

Preparation.—The performer fills both bottles with wine to the extent of their capacity, and corks them. He then inserts the spring bottle into canister No. 2, fastens the catch, and conceals the canister thus prepared among the bran in the wooden box. The lid is not put on the canister, but lies loose among the bran. He then fills the lower portion of the bran bottle with bran, replaces the loose bottom, and places the bottle on the tray. He also charges the funnel. This is done by stopping the opening of the nozzle with the finger, and then pouring wine into the funnel in the ordinary way. The secret space between the inner and outer surfaces will rapidly fill. This done, the air-hole is closed by pressing a little pellet of wax against it, and the performer may then allow the surplus wine to run out of the funnel, with full confidence that the fluid in

the secret chamber will not escape until the air-hole is again opened by the removal of the wax.

Lastly, he places both of the awls in his left coat-tail pocket, the "trick" awl free, the other lightly wrapped in his pocket-handkerchief, but so that the handle is readily get-at-able.

The above preparations having been duly made, the performer comes forward, and delivers an oration to something like the following effect:—

"Ladies and gentlemen, I shall now have the pleasure of showing you a very curious transposition. It is a scientific axiom that a thing cannot be in two places at the same time. I am not so sure about this myself, for if a thing cannot be in two places at the same time, I really don't see how you can account for the extraordinary state of things you will find in this experiment. I have here, you see, a plain tin canister"—(he shows canister No. 1, rattling his wand within it to prove it empty)—"and here, in this box, I have a quantity of bran"—(he takes up a handful or two, and lets it flow back again into the box)—"with which I propose to fill it."

Here he dips the canister *twice* into the box. The first time he fills it with bran, but pours it back again. The second time he exchanges No. 1 for No. 2, taking care, in bringing the latter out of the box, to fill the shallow upper portion with bran; the effect to the spectators being that the canister they have just seen empty is filled with bran from the box. The performer covers it with the lid of No. 1 (the two lids fitting either canister indifferently), and proceeds. "Here I have a bottle of wine." (He uncorks the bran-bottle, and pours some of the wine into a glass, replacing the bottle on the tray. In lifting the bottle, he slips his little finger beneath it, so as to prevent a premature release of the loose bottom.) "I am now going to make these two articles change places in a very mysterious way; but as, from motives of delicacy, they decline to do so visibly, I shall ask your permission to cover them over for one moment, using for that purpose these two pasteboard covers. Pray satisfy yourselves that they are simply what they appear—mere pasteboard tubes. I will place one of them over the bottle, so, and another over the canister, so. Now, at my command the two objects will change places. Where you have just seen the bottle, the canister will appear, while the bottle will take its place under this other cover. Stay! we will make the matter still more complicated. The bran shall come under this cover in place of the bottle; the canister shall go into the wooden box; and the bottle shall—let me see, what shall the bottle do? Ah! the bottle shall fly away altogether. First, let us see that all are as we have placed them." (He raises each cover with the tips of the fingers, and shows that each article is as stated.) "Now, ladies and gentlemen, use all your eyes. Presto! Pass!"

He lifts each cover with a firm grasp, at the same time giving that over the canister a slight turn from left to right in order to release the catch.* The bottom, concealed by the bran, which pours over it upon the tray, drops out of the bran bottle; the bottle is lifted within the cover, and appears to have vanished. In the case of the second cover the canister is carried away within the cover, leaving the spring-bottle, which, being released from the catch, spontaneously expands to its full height, and the performer at once proceeds to pour a little wine from it, to prove its genuineness. If the performer is provided with a "drop-box," or other convenient receptacle, behind his table, he will let the canister and the bran bottle slide out of the covers and fall therein, when the covers may again be offered for examination, while the canister (No. 1) is produced from the bran in the wooden box.

The above ends the trick so far as the bottles and the canisters are concerned;

* The spring bottle should have at bottom three minute points, which dig into the surface of the table, and prevent the bottle turning with the rest of the apparatus.

but the most amusing portion, to a juvenile audience, is yet to come. The performer invites a couple of young gentlemen to take wine with him. A couple of volunteers having been found, a glass of wine is presented to one of them, and duly imbibed, but on preparing to pour out a second, the performer finds that the bottle has run dry. After a moment's consideration, however, he hits on a way out of the difficulty, by taking away from the first young gentleman the wine he has just absorbed, for which purpose he asks permission to make him into a pump. This is effected by making him take hold with the left thumb and finger of the lobe of the left ear, the bent elbow forming the spout. The right arm, held out stiffly from the shoulder, forms the handle. A pump, however, is obviously useless unless it has a hole in the spout, and the performer proceeds to make a hole in the elbow accordingly by boring with the magic awl. In the act of "boring," the blade of the awl recedes into the handle, reappearing as soon as the pressure is removed. Meanwhile, the performer holds his handkerchief, containing the second, or genuine awl, in his left hand, and, after the operation, making believe to wipe the awl he has used, exchanges it for the other, which, being of the ordinary kind, may be thrown carelessly down within reach of the audience, in order indirectly to invite inspection. The performer now takes a wine-glass and the funnel, and after holding up the latter to the light to show that it is empty, applies it to the spout (i.e., the elbow) with the glass beneath it, and requests the other young gentleman to "pump." For a moment or two no effect is produced, till the performer, with the nail of the forefinger, secretly removes the pellet of wax from the air-hole, when the concealed wine begins slowly to flow, apparently from the elbow, into the glass.

The foregoing description may seem somewhat formidable. We have thought it best to describe the trick in the most complete form possible, but there is not the smallest necessity that the young reader should attempt it in its entirety to begin with, nor indeed is it desirable that he should do. The changing of a supposed bottle of wine into a heap of bran is in itself a sufficiently surprising phenomenon, and the pumping of a glass of wine from a person's elbow scarcely less so. These two elements should be exhibited singly until the performer is thoroughly familiar with them, and then—but not till then—he may venture on the complete illusion.

THE FAIRY OMELET PLATE.

It is a humiliating fact, confirmed by the experience of every conjurer, that tricks involving the production of something to eat or drink are always received with special favour, particularly by a juvenile audience. As Mr. Gilbert says:—

"It's human nature, p'raps. If so,
O isn't human nature low!"

The fairy omelet plate is one of the latest appliances for pandering to this depraved appetite, its function being to make a cake or omelet in a hat. To enable our readers the better to appreciate it, we will first describe the old-fashioned apparatus for the same purpose. This is of tin, japanned, and consists of two portions—a bowl, A, slightly tapering in shape, and about six inches in depth (this is the only part of the apparatus which is exhibited to the audience); and a lining, B, of like diameter, but only about four inches deep. This latter is open at either end, but divided into two portions by a horizontal partition. In the wider end a cake is placed, hot if possible, and in this condition B is "loaded" from the *servante* into the borrowed hat. It is then turned so as to bring the larger end downwards, thereby releasing the cake, and bringing the narrow end, which is empty, uppermost. The ingredients for a cake or pudding—flour, milk,

eggs, sugar, currants, etc.—are mixed in A, and thence poured apparently into the unprotected hat, but really into the narrow end of B. In draining out the last drops of the mixture, the performer lowers A for an instant into the hat, and in so doing brings it well over B, which, fitting tightly within it, is brought away with it. The operator then waves the hat about for a minute or two over a spirit-lamp or candle, and after a proper interval declares the cookery complete, and, turning over the hat, submits the result to the practical judgment of the juveniles.

The fairy omelet plate is on the same principle, but is a lighter, more elegant, and more refined contrivance. In appearance it is a little silver plate, six inches in diameter. In reality it is two plates, one within the other, as shown in the sectional view, C exactly fitting within D. There is, however, about half an inch difference in depth between them; C being, internally, very shallow, thereby allowing room for an open cavity on its under side, answering to the smaller end of B in the older apparatus. The cake or omelet, which is necessarily a very small affair, is introduced separately into the hat, and then the performer, after carelessly exhibiting the plate, lowers it for a moment into the hat, on one pretence or another, and in doing so leaves C in the hat, *upside down*. He then breaks an egg into D, adds a pinch of sugar and a pinch of flour, and

TIN FOR MAKING
CAKE IN HAT.



SECTIONAL VIEW.

THE FAIRY OMELET
PLATE.

pours the mixture into the hat (really into the under side of C), and then, as in the former case, withdraws C and D together, with the cake or omelet gracefully reposing on the now clean and brilliant plate, the preliminary mixture being concealed between the two surfaces.

APPARATUS OF GENERAL UTILITY.

There are one or two pieces of magical apparatus which will be found of such constant use by the amateur magician that he will do well to add them to his collection at the earliest possible opportunity. Of these, two of the most important are known as—

THE PLUG BOX AND THE CARD BOX.

The *plug box* is a cylindrical brass box, three inches in height by one and a half in diameter. It derives its name from the fact that it is not closed by a lid or cover in the ordinary manner, but by a closely-fitting cylindrical plug, also of brass, which completely fills it. To all appearance the box and plug are each a single piece of solid brass, but in reality each is in two portions, as shown in the diagram. The box *a* is, in truth, a mere tube, with a movable bottom, *b*, fitting tightly in its place, but capable of being readily pushed out by pressure

from within. The plug *c* has an outer sheath, *d*, as shown by the dotted lines, fitting easily upon *c*, but tightly within *a*.

The box *a* is first shown with the bottom *b* in position, and the plug with the sheath *d* upon it, as in the diagram. The box is then closed by pushing *d* into it to its full extent, when the bottom, *b*, is forced out and falls into the hand of the performer, while the lower surface of *d* comes down flush with the lower edge of *a*. If the plug be now removed, *d* is left within *a*, though the appearance of *a* to the eye of a spectator remains throughout unaltered. If a coin or other small article is, at the outset, placed in *a*, it is forced out with the false bottom into the hand of the performer, who thus gains possession of it, while a substitute (previously placed within *d*) may, if desired, be left in its place.

d

THE PLUG BOX.

THE PLUG.

The plug-box may be used either to "change," to "vanish," or to "produce." For the first purpose the substitute is placed within *d*, and the article to be changed in *a*. To vanish, the article to be got rid of is placed in *a*, and *d* left empty. Where it is desired merely to produce an object, such object is placed in *d*, and the box simply closed, after being shown apparently empty.

The card box is a shallow oblong box of walnut or mahogany, opening book-wise—the upper and lower portions being of the same depth, hinged at back and precisely alike in appearance. In external measurement it is about five inches by three, and one inch deep. Internally, it is of such a size as to hold a pack of cards. The box is polished both on its upper and under sides, so that no difference is perceptible whichever may for the time being be uppermost. A thin slab, one-sixteenth of an inch thick, of unpolished wood, fits loosely within it (see diagram), and when the box is closed, falls spontaneously into that portion which is for the time being undermost. Being of the same wood as the box itself, this slab forms a loose false bottom, not discoverable by the eye alone; what is seen when the box is open being apparently the inner surface of the box itself.

The use of the card box is to change, produce, or vanish a card. The manner of its doing so will be readily understood. To "change," the substitute is beforehand placed beneath the false bottom. The card to be changed is laid in

THE CARD BOX.

the opposite side of the box, opened out flat upon the table, and the box is then closed in such manner that the side containing the false bottom shall be uppermost. When the box is again opened, the false bottom has fallen into the opposite side, covering the original and revealing the substitute card. According as the box is opened with the one or the other side uppermost, either card may be revealed at pleasure; and if one card only be placed in the box, it may be made to appear and disappear in like manner.

The cost of the plug box is about five shillings, that of the card box eightpence. Their uses in conjuring are legion. The trick next described will afford an effective illustration of their employment.

THE TORN CARD TRICK.

The performer places in an ordinary envelope a card (say the knave of spades), from the corner of which he has torn off a piece equal in size to about one-eighth of the whole. The envelope is then carefully sealed. The corner which was torn off the card is placed in division *d* of the plug box, and the plug proper, *c*, inserted therein. The card box is prepared by placing in it a complete knave of spades, covered by the false bottom.

These preliminaries having been duly arranged, the performer is ready to exhibit the trick. His first proceeding is to call attention to the sealed envelope, which he deposits with one of the company for safe keeping. Then, taking a pack of cards, he requests some lady to select one, and proceeds to "force" upon her the knave of spades. If he distrusts his ability to do this with an ordinary pack, he may use a "forcing pack," consisting of knaves of spades only, when the drawing of the right card becomes a matter of course. The lady having accordingly drawn a knave of spades, is requested to tear it across and across into eight pieces, which she is then invited to deposit in the plug box. The performer pushes the plug well home, forcing the bottom, with the pieces of torn card, into his hand. These he gets rid of, at the first convenient opportunity, either behind his table, into a pocket, or elsewhere. The box itself is handed to the lady for safe keeping.

"I dare say you wonder, ladies and gentlemen," says the professor, "at my extravagance in requesting this lady to tear up the card she drew, thereby spoiling a good pack. Fortunately, however, I have a ready means of repairing the damage; indeed, I shall do it so neatly that you will scarcely be able to discover that the card has ever been injured at all. My method is simplicity itself. I shall simply take the fragments, one after another, with my magic wand, and pass them from that brass box into the envelope which this gentleman holds, when they will again unite, and form a perfect card, as at first. May I ask you, madam, to say, for the information of the company, what your card was?" "The knave of spades," is the reply. "The knave of spades? And it was torn into how many—*eight* pieces? Good! Now watch me carefully. I have only to touch the brass box with my wand, and those eight fragments of card will at once pass invisibly into the envelope, leaving the box empty, and re-forming themselves into a complete card as at first. Stop a hit, though! How shall I prove to you that the knave of spades I produce is really the identical card that was torn up? I have it! Instead of taking all the eight pieces, I will take *seven* only, leaving one in the box, and as a natural consequence, that piece will be missing from the restored card. If the piece left behind exactly fits the vacant space, it will prove beyond a doubt that it originally formed a portion of the card, and, consequently, that that is the identical card that was torn up by the lady. Let us try the experiment. Pass!" (tracing an imaginary line with the wand from the box to the envelope). "Did you see them go? Three pieces passed that time. Again!—two more! Once again!—two more, making seven, and leaving *one* in the box. Will you open the box, madam, and see whether the fragments of card have really left it?" The plug box is opened, and the fragment that was originally placed in *d* is found alone. "Now, sir, will you open the envelope?" This is done, and the card taken out, one corner still wanting. "Will you take the card, madam, and compare it with the piece you hold, so as to make quite certain that it is the same card you tore up just now?" This is done, and the corner being found to fit, establishes, or appears to establish, the identity of the card.

"We have succeeded so far," remarks the performer, "but my pack is still spoiled. I cannot use a card with one corner torn off. Fortunately, I shall have

no difficulty in completely restoring it. All I shall have to do is to place it in darkness in this little box" (the card box). He opens the box, and holds it up to show the interior, taking care to so hold it that the fingers keep the loose slab in position. The box, of course, appears empty. "I will put the mutilated card in this box, and the small fragment with it. I close the box. Just one touch with the magic wand, and then—I open the box again, and here is the card, whole as at first." He now opens the box *with the opposite side uppermost*, thereby causing the slab to hide the torn card and its loose corner, and to reveal the complete knave of spades, which is naturally taken to be the same card restored.

THE AUGMENTED COINS.

This is a trick which requires no special apparatus. On a small tray or salver place a number of counters, gilt in imitation of sovereigns (these may be purchased at a very small cost), and ask of the audience if some one of their number will kindly consent to have the coins passed into his hands or pockets. There will usually be a dozen volunteers, causing the performer very naturally to remark that one will be sufficient to show his power, and that, however much of a wizard he may be, he yet cannot endow all present with unlimited wealth. Selecting one of those who responded, the conjurer invites him to step up to the table, and take from the tray a handful of the coins. This having been done, the remainder of the counters are emptied from the tray on to the table. The person who has taken the handful of coins should next be asked to count them, and the performer at the same time must approach him, with the empty salver held between the thumb and forefinger of the right hand, in order that the coins, as they are counted, may be placed therein. It may here be observed that in the right hand and underneath the salver the performer holds concealed a small number of similar coins or counters; for convenience of illustration, we will say six. These counters may easily be concealed from sight, inasmuch as the fingers which are to hold them will be naturally covered by the tray. As the assisting spectator counts the coins one by one, the performer repeats after him the numbers as they are named, to prevent any mistake or misunderstanding, until he has finished, having reached, we will suppose, *twenty-two*. He should now be requested to be good enough to take in one of his hands these twenty-two pieces, and the performer, suiting the action to the word, here pours the twenty-two coins or counters into his own right hand, where they naturally mingle with the six concealed there as before mentioned, and at once places the whole twenty-eight in the offered hand of the spectator. Six coins so added to twenty-two will not be detected; but to prevent the possibility of the assistant endeavouring again to verify their number, he is requested to keep the hand holding the coins as tightly closed as possible, and in the other hand to hold the salver, as it will again be required a moment later.

The operator should now return to his platform or behind his conjuring table, and request that the coins may be held up in the closed hand a little above the heads of the audience, so that no one may be struck by the coins that are about to fly from the performer and take their place with those held out. He then takes from the table a handful of counters, with apparent indifference as to quantity, but really taking care to have exactly seven, being *one more* than the number just added. These he counts one by one, allowing the entire audience to see that there is "no deception." He reminds the audience that the spectator assisting him holds twenty-two, and points out that with the seven about to be passed to him there should then be twenty-nine. At this juncture the performer executes the *tourniquet* (see p. 910), the seven coins being dropped into the hollow of the left hand. He at the same time bends towards

that part of the audience where the assistant for the time being is situated, and asks him to come nearer the platform, indicating by means of his *right* hand the exact direction in which the assistant should move. This motion of the right hand momentarily diverts the attention of the audience from the left hand, which forthwith secretes the coins in some part of the attire of the performer. Everything is now ready for the mystic "pass," which the performer pronounces accordingly; and immediately after inquires whether the shock of the advent of the additional counters was not felt. He invites the audience to verify, by counting, that the additional coins have duly reached the assistant's hand; and while all eyes are so occupied, gets possession secretly of another counter, and holds it, unperceived, in the right hand. The assistant has, of course, but *twenty-eight* counters in his hand, inasmuch as the actual number added was but six. It frequently happens, however, that distrusting his own accuracy, he reports that he has twenty-nine, in which case, the tale being apparently complete, the trick may be allowed to end there. If, on the contrary, he reports that there are twenty-eight only, the performer feigns a momentary embarrassment, but speedily recovering himself, suggests that in that case one of the coins must have fallen by the way, and after glancing around for a moment, proceeds to verify his assertion by producing the missing coin (really the palmed one) from some lady's muff, glove, or handkerchief lying in the line of transit. The article should be picked up and shaken, the coin apparently falling from it. The supposed failure thus really enhances the effect of the trick.

THE GOLD-FISH TRICK; TO BRING BOWLS OF WATER IN WHICH FISH ARE SWIMMING OUT OF AN EMPTY CLOTH.

The performer advances on the stage, and stands quite apart from any surrounding objects; there is nothing in his dress in any way unusual, and nothing in his hands save an ordinary cloth about four feet square, which the spectators are permitted to examine. Upon the cloth being returned to him, he throws it over his left arm and hand, and after a few seconds produces from under it a glass bowl full of water, in which gold-fish are seen to be swimming (see Fig. 1); the cloth is again thrown into the air, shaken, and examined, and again a bowl is produced from apparently nowhere. The explanation of the trick is as follows:—Fig. 2 represents an



Fig. 1.—BOWL WITH GOLD-FISH.



Fig. 2 —INDIA-RUBBER COVER.

pearance shown in Fig. 3. The bowl, as thus covered, can be turned upside down and carried sideways without any fear whatever of the water being spilt. The next point is how to conceal it about one's person. Fig. 4 represents a small black bag capable of holding two such bowls in an upright position (the glass bottom of one in contact with the india-rubber cover of the other). This is tied round the waist, the tail of a dress-coat being amply sufficient to hide it.



Fig. 3.—THE BOWL COVERED OVER.

All the sleight-of-hand required for the trick is so to manage the cloth that it hides the movement of the right hand and arm in bringing the bowl out of the pocket into position. When the bowl is brought under the cloth, rest the bowl on the right hand, and bring away the left from under the cloth. In taking off the cloth, peel off the india-rubber cover by means of the left-hand finger and thumb through the cloth. The cover remains in the cloth, whence it must be

FIG. 4.—THE BAG FOR CARRYING THE BOWLS.

secretly conveyed into your pocket or elsewhere while the general attention is called to the bowl. The direction of the conjurer's eyes must be with the bowl, as should the eyes rest on the cloth after the bowl has been taken out, people will at once suspect that there is something there, and possibly put awkward questions, or ask to examine the cloth too soon. If it be desired to produce a third bowl, this should be placed under the left arm inside the coat, with the cover next the body, the pressure of the arm keeping it in position till wanted. This bowl should be the first produced, the other two following.

FIRESIDE FUN.

DURING the long winter evenings, when families are assembled together for the Christmas vacations, pleasant and profitable hours may be spent quietly sitting round the fire and indulging in such mental games and pastimes as will be explained in this section. The English language is composed of words of various construction, and it is our intention in the few following pages to describe some of the many ways in which combined amusement and information may be obtained by exercises in word and letter puzzles; to speak of the different kinds of acrostics, enigmas, charades, rebuses, and the like, and how they are made; to give a few examples of each; and generally to do what we can to help wile away pleasantly some of those hours which, it is feared, in some circles may hang heavily for want of that specific instruction which it will be our object to impart. Moreover, as several branches of "Fireside Fun" deal with authors, cities, rivers, countries, mountains, and other matters, fair opportunity is offered to our young friends to turn to account such knowledge as they possess; but it is hoped that such rivalry as may ensue may always be generous and good-natured.

DECAPITATIONS.

THERE are English words in abundance which, being shorn of their initial letter or syllable, form other words of different meanings. Such words will be considered under the heading of "Decapitations." It will always afford amusement and interest to an assembled company if some one of their number selects an appropriate series of words, and gives an impromptu arrangement, in prose, doggerel verse, or good rhyme if he can, of the several significations of the various words thus arrived at, leaving others to puzzle out the series of words from the descriptions given. In propounding the puzzle, in this and in other cases to be hereafter described, the proposer should exercise his wit and ingenuity in making it as amusing as possible. A judicious play upon words is always appreciated, and sure to cause mirth; indeed, the maxim "that the worse the pun the better the joke" should be borne in mind and acted upon when indulging in "Fireside Fun."

We proceed with a few illustrations of "Decapitations," the appropriate solution being given after each puzzle:—

My whole is a word of one syllable, and expresses a species of grain.
 Behead me, and you make me very warm.
 Once again, and at meal times I shall be called into requisition.
 And yet again remove my initial letter, and I remain a simple preposition.
Answer : Wheat, heat, eat, at.

My whole is but an atom when complete;
 You'll find it both in light and heat.
 Behead me once, and you behold
 A pleasure ground for young and old.
 Decapitate again, and you will find
 I long ago preserved mankind.
Answer : Spark, park, ark.

I have used all my whole this puzzle to frame,
But if you behead me, then murder you name ;
Behead me again, and not dead as supposed,
For I still live and breathe, but am much indisposed.

Answer : Skill, kill, ill.

As an illustration of "Decapitation" of words by syllables rather than by letters, we give the following :—

My whole is significant of dissolution.
Behead me, and I am a school exercise significant of construction.
Behead me again, and I denote the place attained by the exercise.

Answer : Decomposition, composition, position.

My whole is unbearable.
Beheaded, I am bearable.
Again beheaded, I am easily moved.
Once more beheaded, I remain a solid piece of furniture.

Answer : Insupportable, supportable, portable, table.

The following words, among many others, are suitable for "Décapitation" :—

Abate (bate, ate) ; abundance (bun, dance) ; abroad (broad, road) ; bail (ail, il, French for he) ; bland (land, and) ; clout (lout, out) ; discomfort (comfort, fort) ; draft (raft, aft) ; drear (rear, ear) ; drill (rill, ill) ; drink (rink, ink) ; dwell (well, ell) ; encompass (compass, pass) ; invalid (valid, lid) ; chair, (hair, air) ; seat (eat, at) ; shire (hire, ire) ; slate (late, ate) ; and so forth.

CURTAILMENTS AND RETAILINGS.

HERE we find an enlargement and modification of the "Decapitation" series of puzzles, obtained by varying the endings as well as the beginnings of words, or by varying the endings only. From the examples given it will be seen that it is legitimate to make these variations in different ways. The first examples involve the removal of final letters only to make words of different significance.

Complete, I am a privilege exclusive,
By many sought with hope illusive ;
Curtail me, and for sacred use I'm claimed ;
Once more, and your own head you've named ;
Curtail again, in Erin's Isle I then abound,
And if again you venture, a father will be found.

Answer : Patent, paten, pate, Pat, pa.

Curtail a patriarchal dwelling-place, and find the number of that council in ancient Rome of which Appius Claudius was the chief.

Answer : Tent, ten.

Curtail the miser's treasure, and it becomes grey with age or white as the frost on the grass.

Answer : Hoard, hoar.

A monarch curtailed becomes to all a blood relation, said by Hamlet to be less than kind.

Answer : King, kin.

Curtail that organ which is said by some to be the seat of all emotion, and there remains one of the five senses.

Answer : Heart, hear.

In many words the final letters, particularly the last three, when standing alone, do not, unless re-arranged, express a word conveying sense or meaning, but by an easy and simple re-arrangement or transposition can be made to do so. This may be seen in such words as—

Sword, word (*ord* transposes into *rod*).
Scent, cent (*cnt* transposes into *ten*).

Puzzles of this class are usually included among "Retailings," and the above examples of "sword" and "scent" are examples combined of both Decapitation and Retailing.

Again, in other words, the finals can be made to express two or more words of different meanings, as—

Fowl, owl (which also transposes into *low*).
Scant, cant, ant (which also transposes into *tan*).

The following is a combined Decapitation and Retailing puzzle, the retailing being effected by a transposition of the letters:—

Strike my whole, and 'twill give you a light.
Behead and retail me, I'm the gossip's delight.
Behead me once more, and your heads I'll adorn;
Once again, and I'm left at last all forlorn.

Answer: Match, chat (*atch* transposed), hat, at.

Many words of more than one syllable may be treated under this puzzle, by lopping off the original ending and substituting some other which will make a word of an entirely different meaning, thus:—

Retail what is needed to bury the dead,^a
With that on which doctors rely for their bread;^b
These together combined should be bright and clear,
And be taken for breakfast without any fear.^c

Answer: ^a Coffin, ^b fee, ^c coffee.

We will now give a few puzzles founded on one or more of the previous examples; but our young readers will find that "Retailings" offer a much wider range of words from which to select than do "Decapitations." More fun, however, will be obtained by combining the two. The word *transpose* is used in some books instead of *retail*; but *transpositions*, properly so-called, will be treated later on:—

Complete, I am common,
Beheaded, I am a ceremony,
Retailled, I am a head-dress.

Answer: Trite, rite, tire.

Complete, I am a servant,
Beheaded, I am an apartment,
Retailled, I am an extensive waste.

Answer: Groom, room, moor.

Complete, I grow within a field
And pleasant pasture often yield;
Decapitate, a suitor then
Is quickly brought before your ken.
Behead again, I am a word
Oft on the cricket field is heard.
Restore my head, cut off my tail,
To name a spice you will not fail.

Behead me now, and you will find
 The master passion left behind.
 Complete me as I was before,
 Put on my head, my tail restore,
 My second letter take away,
 An envelope I am, you'll say.
 Now, if you but curtail once more,
 I'll show an inlet on the shore.

Answer : Clover, lover, over, clove, love, cover, cova.

A word expressing bitter hate
 My total does disclose,
 'Tis shared alike by small and great
 'Twixt those who still are foes.
 Now change the scene, take off my head,
 A lady comes to view,
 A sweeter name may ne'er be said
 Than this, if tales be true.
 Decapitate once more, and lo !
 Small insects now appear ;
 Retail at once, in French 'twill show
 Whence daylight comes so clear.
 Restore, take off my head again,
 In winter I am seen,
 In summer, too, I'm cooling when
 Your lips are parched, I ween.
 My whole restore, yet not my tail,
 Transposed, then I will name
 What we in justice cannot fall
 To designate a claim.

Answer : Malice, Alice, lice, ciel, ice, claim.

Complete, I am shrill ;
 Beheaded, a musical instrument ;
 Beheaded and transposed, I denote equality,

Answer : Sharp, harp, par.

Complete, I'm in a difficulty.
 Behead me, and I show signs of grief,
 Once more, and I am a useful seed ;
 Again, and I am what philosophers name our ancestors,
 Transposed, I am a vegetable.

Answer : Scrape, crape, rape, ape, pea.

Complete, I am a reproof.
 Beheaded, I am a portion of land.
 Beheaded again and transposed, and I become the lot of all humanity.

Answer : Chide, hide, die.

Complete, I am without rule or method.
 Beheaded and transposed, I am a mythological true friend ;
 Again, and I give expression to sounds of grief.

Answer : Random, Damon, moan.

My whole is a metal.
 Beheaded, curtailed, and transposed, I am a noted English poet.
 Beheaded and transposed, I then become an American poet.
 Curtailed again, and I name one of Italy's chief rivers.

Answer : Copper, Pope, Poe, Po.

Sufficient examples of puzzles of this nature will have been given to show that very many of the words of every-day use may be made to serve for Retailings. Still another form of the word puzzle known as Retailings consists in

choosing some word which, upon the addition of one or more letters at the end, will make one or more different words of distinct meanings, as in the following examples :—

I am often heard in parliamentary debates. Retail me, and I am the seat of all affections and passions; retail me again, and I am your near neighbour when seated round the fireside.

Answer : Hear, heart, hearth.

I am a disagreeable noise. Retail me, and I help to express an agreeable sound; retail me again, and I am sullied and soiled.

Answer : Din, ding (*ding, dong*, the sound of bells), dingy.

I am an earl famous in Scottish story. Retail me, and I am used for manure; once more, and expect stormy weather.

Answer : Mar, marc (refuse of fruit and seeds from which the oil has been pressed), March.

I am a plant and its fruit. Retail me, and I am a well-known fruit; retail me again, and I am a gem.

Answer : Pea, pear, pearl.

I am of great warmth. Retail me, I am bleak and barren; retail me again, and I am a pagan.

Answer : Heat, heath, heathen.

ANAGRAMS.

THE inversion or transposition of the letters of a word or sentence to form a new word or phrase is an anagram. This is indeed a literary amusement which will extend the intellect and quicken the thinking powers of all ingenious riddlers who seek to excel in this mental pastime. In past ages it engaged the attention of statesmen and divines, and many wise and witty persons have devoted their leisure hours to this exercise of ingenuity.

The term anagram, in its proper sense, means the letters of one or several words written backwards, being derived from two Greek words "*ana*" (backwards) and "*gramma*" (letter). Thus the word *live* would form its anagram—*evil*; but the term anagram is now used in the wider sense in which we have used it. Our young friends must not be discouraged at their first attempts in forming anagrams—their anagrams may have little merit, crude efforts seldom have much to recommend them—but perseverance here, as elsewhere, will be rewarded. The true merit of an anagram springs from an apt association of ideas, and a close relation between the transposed words and the original from which they are derived. This involves much practice, great thought, and an infinitude of patience, but is productive of real enjoyment.

The father of the Earl of Beaconsfield, Isaac D'Israeli, devoted a chapter in his "*Curiosities of Literature*" to a consideration of the anagrams which he had met with in his wonderful research. The chapter should be read by all who wish to excel in these literary exercises, and from it we have selected a few of the choice specimens recorded therein :—

"Charles James Stuart—claims Arthur's seat," "James Stuart—a just master." "An eccentric dame in the reign of Charles I. believed herself to be gifted with the spirit of prophecy, but as her prophecies were usually against the Government of the day, she was eventually brought by them into the Court of the High Commission. She based her claim as prophetess upon an anagram she had formed on her name: 'Eleanor Davies—Reveal, O

Daniel.' This anagram was imperfect, as it had one *l* too many, and the letter *s* was omitted, but it satisfied her. The bishops reasoned with her out of the Scriptures to no avail, but one of the Deans of Arches vanquished her with her own weapons. He took a pen and hit upon this excellent anagram, 'Dame Eleanor Davies—Never so mad a ladie.' "

An anagram on Princess Charlotte, daughter of George IV., is also considered worthy of record :—

"Princess Charlotte Augusta of Wales," transformed into "P.C., her august race is lost. O fatal news."

The elder D'Israeli had a keen perception and a thorough appreciation of the points in a good anagram. If this is hereditary, the younger Disraeli, the late Prime Minister of England, no doubt appreciated the ingenuity of the opponent who converted his title into a stinging comment on the result of the general election of 1880 :—

"The Earl of Beaconsfield—Self-fooled ; can he bear it ?"

The names of celebrated men and women of the present day, and those who have come down to us in the pages of history offer a wide field for the young riddler.

The following are samples, new and old, of this species of anagram, which we have collected from various sources, in the hope that they may incite our young friends to fresh exertions :—

"Louis Napoleon—Ape no lion, Soul."

"Lord Monteagle (he who gave information of the Gunpowder Plot)—Go, tell no dream."

"Horatio Nelson—Lo ! nation's hero."

A better one than this was composed by Dr. Burney—

"Honor est a Nilo—His honor is from the Nile."

"Marie Antoinette—Tear it, men ; I atone."

"Selina, Countess of Huntingdon—See, sound faith clings to no nun."

"James Watt—Wait steam (the 'J' being converted into 'I')."

"Lord Palmerston—So droll, pert man."

"William Ewart Gladstone—A man to wield great wills."

"Leon Gambetta—Able man to get."

"Florence Nightingale—Cling on, feeling heart."

"The Marquis of Lansdowne—Landowner, oft squeamish."

"Alfred Tennyson, poet laureate—Neat sonnet or deep tearful lay."

It will be noticed that several of the examples that we have given are particularly apt, anagrammatically describing some special feature in connection with the person selected for experiment.

The names of flowers, birds, &c., can be treated in like manner and afford much amusement. For instance, who would recognise "The calceolaria" when transformed into "Eat coal, Charlie," or the "Geranium," "Ear in mug," the "Heliotrope," "Hit or clope" ?

Bird-fanciers would be at a loss to discover "The nightingale" in "High gale in tent," or "The turtle dove" in the words "Eve, let truth do." And if we turn to Natural History fresh illustrations abound—"Cool'd rice" effectually disguises that carnivorous reptile the "Crocodile."

WORD SQUARES.

THIS is a form of word puzzle which has only to be known to become widely popular, demanding ingenuity and patience of no common order before it is mastered. On first setting out we will confine ourselves to words of four letters. Each line of words from left to right and downwards must form the same word. One example will clearly show our meaning.

1	M	E	A	D
2	E	D	G	E
3	A	G	U	E
4	D	E	E	D
	1	2	3	4

These letters being read from left to right and downwards, the first row and the first column will be found to form the same word; the second row and the second column the same; and so on. This is the basis of the puzzle. It requires some research to select the fitting words, when words of four letters only are used, but when words of five letters are employed we are more puzzled; with words of six letters our perplexities increase, and upon proceeding to higher numbers we are almost prompted to be content with what has already been attained. But difficulty is the great charm to the true riddler, who finds the construction

of riddles to be "a whetstone of patience," as Camden aptly named the exercise.

In propounding these puzzles the synonyms only of the different words out of which the puzzle squares are to be formed are to be supplied, and care must be taken in the selection of the words that they are of the same number of letters. The following illustration will assist to make our meaning clear:—

1. Compensations (Amends). 2. A favourite (Minion).
3. To assist (Enable). 4. To eat sparingly (Nibble). 5. A coin (Dollar). 6. Sarcasms (Sneers).

1	A	M	E	N	D	S
2	M	I	N	I	O	N
3	E	N	A	B	L	E
4	N	I	B	B	L	E
5	D	O	L	L	A	R
6	S	N	E	E	R	S
	1	2	3	4	5	6

The riddler has to puzzle out the answers of the six words, and write down the answers as shown in the accompanying diagram, always being careful to see that the words, when written out, are the same in the columns and rows of the corresponding numbers.

This illustration will completely let our readers into the mysteries of "word squares," and we will now give a few specimens selected from a large quantity which have come under our notice.

Four letters.

- (1) A river in Oxfordshire
(2) A portion of our body
(3) A thought
(4) A chair

I	S	I	S
S	I	D	E
I	D	E	A
S	E	A	T

- (1) A very common male Christian name
(2) A river in the United States
(3) The noise of a serpent
(4) A portion of the human face

J	O	H	N
O	H	I	O
H	I	S	S
N	O	S	E

- (1) My first has regal powers to sway,
(2) Is worshipped as my second, in a way;
(3) In harmony my third is sweet and clear;
(4) My fourth 'midst hills is ever near.

K	I	N	G
I	D	O	L
N	O	T	E
G	L	E	N

Five letters.

- | | | | | | |
|---------------------------------------|---|---|---|---|---|
| (1) A period of time | W | E | E | K | S |
| (2) A very common female name | E | L | L | E | N |
| (3) To avoid by artifice or stratagem | E | L | U | D | E |
| (4) A small anchor | K | E | D | G | E |
| (5) A contemptuous contortion of face | S | N | E | E | R |

Six letters.

- | | | | | | | |
|-------------------------------------|---|---|---|---|---|---|
| (1) A poetical name for old England | A | L | B | I | O | N |
| (2) A Portuguese province in Africa | L | O | A | N | D | A |
| (3) A town in East Prussia | B | A | R | T | E | N |
| (4) Something aimed at or designed | I | N | T | E | N | T |
| (5) A town in Denmark | O | D | E | N | S | E |
| (6) A town in France | N | A | N | T | E | S |

BIRDS, FRUITS, AND FLOWERS ENIGMATICALLY EXPRESSED.

LITTLE difficulty will be experienced in the construction or solution of this simple form of enigma. It will, however, be found to possess a charm all its own, which will add greatly to the mirth and gaiety of the social circle. The following examples will let our readers into the whole secret of this pleasant pastime:—

Birds. — What a severe attack of quinsy prohibits you from doing.

Ans.—Swallow.

An architect well known to fame.

Ans.—Wren.

A portion of a whole, and a continued range of hills.

Ans.—Part-ridge.

What a coward does in the hour of danger.

Ans.—Quail.

Equality, and a state of utter decay.

Ans.—Parrot.

A monarch, and a toiler of the seas.

Ans.—King-fisher.

Fruits. — A vowel, and a cooking apparatus.

Ans.—O-range.

To give way to anxiety and sorrow.

Ans.—Pine.

The greatest crime in a school-boy's calendar.

Ans.—Peach.

The colour of growing herbage, and a challenge.

Ans.—Green-gage.

Flowers.—The title of one of Macaulay's Lays, and the name of one of the public funds.

Ans.—Virginia Stock.

What a good conscience gives to its possessor.

Ans.—Heart's-ease.

An Irish vehicle, and a people who live under one government.

Ans.—Car-nation.

What honey is, and the name of more than one king.

Ans.—Sweet-william.

A religious devotee, and a babe's head gear.

Ans.—Monk-hood.

A noted Quaker, and a handy article of dress.

Ans.—Fox-glove.

REBUSES.

DR. JOHNSON and succeeding dictionary makers give as the meaning of the word Rebus, "a word represented by a picture;" but we need not go further than its literal translation, "by things," to arrive at a true idea of this enigma. The Rebuses with which we are now about to concern ourselves will be formed by a series of objects (things) which, when taken as a whole, will be found to complete the riddle. This is a pastime in which many of our great men have taken delight. Lord Macaulay is to be credited with the following:—

Here's plenty of water you'll all of you say, (c) Sea
And, minus the h, a thing used every day, (a) Hay
And here is nice beverage, put them together; (t) Tea
What is it, with claws, but with never a feather? CAT.

We doubt whether this was one of the historian's first efforts, for every endeavour must have a beginning, and this rebus bears the marks of a practised hand.

Subjoined are further examples of the Rebus enigma:—

^a A gatherer of honey; ^b a form of supplication; ^c a fruit; ^d a bird; ^e a title; ^f a fish oft found on the breakfast-table; ^g one of Ireland's emblems; ^h a forest tree; ⁱ a county in the north of England.

If these you rightly puzzle out,
'Twill prove you know what you're about.
Th' initials joined will show a word
Which as applied to you 's absurd.

Answer: ^a Bee; ^b Litany; ^c Orange; ^d Canary; ^e King; ^f Haddock; ^g Emerald;
^h Ash; ⁱ Durham.—BLOCKHEAD.

- (a) The flower that vies in beauty with the rose;
- (b) An emblem of peace;
- (c) A dark blue flower, with green leaves, which blooms in shelter;
- (d) The sweet briar will recall my name.

These joined together, as above,
The word will surely rhyme with dove.

Answer: ^a Lily; ^b Olive; ^c Violet; ^d Eglantine.—LOVE.

First in the path of Duty, (D)
And ranking first in Art, (A)
Foremost in Virtue and in Vice, (V)
Leading all in Immortality, (I)
And foremost in Devotion. (D)
Pore over these with studious care,
A kingly name is hidden there.

Answer: DAVID.

Eleven letters I contain;
And if you now would find the same,
Know that a figment of the brain
Will straightway help you to my name.

My 2, 3, 6 is a human being; my 4, 5, 6 is a snare; my 2, 3, 4 is a contraction of a girl's name; my 6, 7, 8 is a contraction of a boy's name; my 8, 10, 11 is the name of a weight; my 11, 10, 8 implies negation; my 4, 10, 8 is the past tense of a verb signifying to acquire; my 2, 3, 8 is a web of rope yarn; my 1, 6, 11 is a place of entertainment for man and beast; my 2, 1, 6, 8 is the name of an aromatic plant; my 6, 7, 8, 9, 10, 11 is an immense combination of people.

Answer: 1 2 3 4 5 6 7 8 9 10 11
I m a g i n a t i o n.—IMAGINATION.

ARITHMOREMS.

THE Arithmorem is, perhaps, the most modern of all riddles, and will, we anticipate, be a novelty to many of our readers. In its construction, figures are substituted for Roman numerals, and letters are added to complete the word it is desired to disguise. These letters, however, may be, and indeed should be, transposed out of their proper order, so that the solution of the riddle may be the more difficult. For example, "54 and e," written as follows, by substituting the Roman numerals LIV. for the figures 54, give LIVE. That is an Arithmorem in its first stage and simplest form. Our examples will illustrate its fuller development. It must, however, be understood that in the solution the words used are to be looked upon only as so many letters and treated accordingly, as is the case in anagrams.

- (1)
- | | | |
|-----|---------------|------------------------------------|
| (a) | 602 and fee | (a handsome structure). |
| (b) | 201 „ orant | (a medicine to produce sleep). |
| (c) | 1550 „ osage | (to be happy and joyous). |
| (d) | 57 „ ten song | (a famous traveller). |
| (e) | 151 „ egan | (partaking of a celestial nature). |
| (f) | 56 „ stone | (an author or authoress). |
| (g) | 556 „ e | (the incarnation of evil). |

The initials will name a country dear to all lovers of liberty and freedom :—

Answer : (a) 602 = $\begin{smallmatrix} D & C & I & I \\ 2 & 6 & 8 & 5 \end{smallmatrix}$ and F E E, or Edifice.

(b) 201 = $\begin{smallmatrix} C & C & I \\ 4 & 8 & 7 \end{smallmatrix}$ „ O B A N T, „ Narcotic.

(c) 1550 = $\begin{smallmatrix} M & D & L \\ 7 & 4 & 2 \end{smallmatrix}$ „ O S A G E, „ Gladsome.

(d) 57 = $\begin{smallmatrix} L & V & I & I \\ 1 & 3 & 2 & 4 \end{smallmatrix}$ „ T E N S O N G, „ Livingstone.

(e) 151 = $\begin{smallmatrix} O & L & I \\ 7 & 5 & 6 \end{smallmatrix}$ „ E G A N, „ Angelic.

(f) 56 = $\begin{smallmatrix} L & V & I \\ 5 & 3 & 6 \end{smallmatrix}$ „ S T O N E, „ Novelist.

(g) 556 = $\begin{smallmatrix} D & L & V & I \\ 1 & 5 & 3 & 4 \end{smallmatrix}$ „ E „ Devil.

—ENGLAND.

Arithmorems may be elaborated so as to partake of the nature of double acrostics, as in the next examples :—

- (2)
- | | | |
|-----|-------------------|----------------------------------|
| (a) | 751 and e pay one | (a book of reference). |
| (b) | 550 „ a no go | (a Venetian mode of conveyance). |
| (c) | 100 „ thy ear | (an amateur sailor). |
| (d) | 6 „ spoor | (a conditional stipulation). |
| (e) | 1050 „ e satan | (an improvised juror). |

The initials and finals read downwards will name, the former the country from which the latter assisted a whole nation to emigrate :—

Answer : (a) 751 = D C C L I and E P A Y O N E, or E ncyclopedi A.

(b) 550 = D L „ A N O G O, „ G ondol A.

(c) 100 = C „ T H Y E A R, „ Y achte R.

(d) 6 = V I „ S P O O R „ P rovis O.

(e) 1050 = M L „ E S A T A N, „ T alesma N.

—EGYPT, AARON.

- (3)
- | | | |
|-----|---------------|--|
| (a) | 51 and a bath | (a large flat fish). |
| (b) | 51 „ a nob | (a name given to persons whose hair is not of a natural colour). |
| (c) | 5 „ ber | (a part of speech). |
| (d) | 551 „ asu ana | (a Spanish province). |
| (e) | 201 „ ran to | (a stupefying drug). |
| (f) | 102 „ r n t | (an acid). |
| (g) | 250 „ uoapa | (a town on the Mexican coast). |

The initials and finals, read as before, will resolve themselves respectively into the name of a well-known town in the West Indies, and the chief product for which it is celebrated:—

Answer: (a) 51 = L I and U B A T H, or H alibu T.
 (b) 51 = L I „ A N O B, „ A lbín O.
 (c) 5 = V „ B E R „ V er B.
 (d) 551 = D L I „ A S U A N A, „ A ndalusí A.
 (e) 201 = C C I „ R A N T O, „ N arcoti C.
 (f) 102 = C I I „ R N T, „ N itri C.
 (g) 250 = C C L „ U O A P A, „ A capulo O.

—HAVANNA, TOBACCO.

Without giving the full details, as above, showing how the puzzles are to be worked out, we will now give some examples of Arithmorems which form the names of persons who have, in their different ways of life, made those names illustrious and honoured. Afterwards will be found the titles of books, names of birds, beasts, and fishes. These various examples will show what a vast source of entertainment is here disclosed for the display of wit, ingenuity, and knowledge.

- | | | |
|-------------|----------------------------|---------------------------------|
| 1—1,051 and | <i>run the tar,</i> | Is honoured as a reformer. |
| 2—550 „ | <i>after the rage.</i> | Is honoured as a kingly king. |
| 3—1,251 „ | <i>shout brush rope.</i> | Is honoured as a discoverer. |
| 4—102 „ | <i>no east warns.</i> | Is honoured as a mathematician. |
| 5—701 „ | <i>H. larks seen.</i> | Is honoured as a novelist. |
| 6—150 „ | <i>hat, robe or tent.</i> | Is honoured as a novelist. |
| 7—550 „ | <i>Yes, fear not, n.n.</i> | Is honoured as a poet. |
| 8—1,506 „ | <i>Ad hue.</i> | Is honoured as an historian. |

ANSWERS.

¹Martin Luther, ²Alfred the Great, ³Christopher Columbus, ⁴Sir Isaac Newton, ⁵Charles Dickens, ⁶Charlotte Bronte, ⁷Alfred Tennyson, ⁸David Hume.

Puzzles.

- | | |
|---------|-----------------------|
| 101 and | Or burn nose so. |
| 657 „ | Few fear oak. |
| 1,552 „ | Ah! for that one. |
| 151 „ | A pen. |
| 1,001 „ | Pat rang. |
| 1,100 „ | Roar not. |
| 50 „ | A pet one. |
| 550 „ | Opera. |
| 1,500 „ | Or ye dar. |
| 105 „ | No hay. |
| 2 „ | Bet what. |
| 651 „ | Harp. |
| 50 „ | On port lent a hoy. |
| 551 „ | In jam is bee ran. |
| 51 „ | Cors nil ort mem. |
| 101 „ | Sink oil well. |
| 100 „ | Nor real meat fry. |
| 105 „ | To pay more rent. |
| 1,500 „ | For jaunty he on sea. |

Answers.

- | |
|-----------------------|
| Robinson Crusoe. |
| Vicar of Wakefield. |
| Heart of Midlothian. |
| Pelican. |
| Ptermigan. |
| Cormorant. |
| Antelope. |
| Leopard. |
| Dromedary. |
| Anchovy. |
| Whitebait. |
| Pilchard. |
| Anthony Trollope. |
| Benjamin Disraeli. |
| Mortimer Collins. |
| Wilkie Collins. |
| Florence Marryat. |
| Coventry Patmore. |
| James Anthony Froude. |

It will afford a capital exercise in the use of the Roman numerals if our young readers will amuse themselves by working out the details of the solutions of the aforesaid puzzles and answers.

DIAMOND PUZZLES AND WORD PUZZLES OF VARIOUS SHAPES.

THESE puzzles are formed upon the same general principle as described in "Word Squares." The peculiarity of the different puzzles is disclosed in the names, and we will proceed by giving one example of each.

The *Diamond Puzzle* is arranged by selecting letters or words that may be set forth in the shape of a diamond, thus:—

Puzzle.

- 1.—A letter that is both vowel and consonant.
- 2.—A Jewish tribe.
- 3.—A Trojan woman.
- 4.—A character in "Guy Mannering."
- 5.—A Grecian hero.
- 6.—A novelist and poet.
- 7.—A character in *The Tempest*.
- 8.—A character in *Love's Labour's Lost*.
- 9.—Effervescence.
- 10.—A letter of the Greek alphabet.
- 11.—A consonant.

Answer.

W
D A N
H E L E N
B E R T R A M
A G A M E M N O N
W A L T E R S C O T T
S E B A S T I A N
M E R C A D E
F R O T H.
E T A
T

The central letters read downwards or horizontally name a great novelist and poet—Walter Scott.

The following is an example of a *Diagonal Puzzle*:—

Puzzle.

- 1.—My first is a ticket.
- 2.—My second is a voice in music.
- 3.—My third is a water-bird.
- 4.—My fourth is an expensive ornament.
- 5.—My last is a sharp instrument, useless to boys, but often longed for by boys.

Answer.

L A B E L
T E N O R
D I V E R
J E W E L
R A Z O R

Read from left to right, diagonally, and *vice versâ*, as shown by the capital letters, and discover the names of two Irish writers of rollicking humour—Lever and Lover.

The *Conical Puzzle* is arranged in this manner:—

Puzzle.

- 1.—A consonant.
- 2.—An English river.
- 3.—An island builder.
- 4.—Furrows cut by a tool.
- 5.—A lover's message.

Answer.

B
W Y E
C O R A L
G R O O V E S
V A L E N T I N E

The central letters read downwards as in the Diamond Puzzle will give the name of one of England's great poets—Byron.

The next example is of an *Oblique Puzzle*:—

Puzzle.

- 1.—Malicious retaliation.
- 2.—A musical term.
- 3.—An ecclesiastical assembly.
- 4.—A Scottish river near Elgin.
- 5.—The pen's close companion.
- 6.—A negative.
- 7.—A personal pronoun.

Answer.

R e v e n g e.
O c t a v e.
S y n o d.
S p e y.
I n k.
N o.
I.

The initials form the name of a celebrated composer of music—Rossini.

The next form given is *Pyramidal* :

Puzzle.

- 1.—A consonant I serve to name,
 - 2.—A portion of the human frame,
 - 3.—A title of nobility,
 - 4.—Similitude behold in me,
 - 5.—A town that may in Wales be found,
 - 6.—With blood I ever do abound,
 - 7.—And I an English town proclaim.
- In Durham you may find the same.
Now take the centres, which are meant
To tell you what I represent—Pyramid.

Answer.

P
E Y E
B A R O N
P A R A B L E
B E A U M A R I S
S A N G U I N E O U S
B A R N A R D C A S T L E

The last form we give is that of a *Cross* :—

- A female name.
Hostility.
Metal.
Partaken of food.
The mind satisfied by evidence.
A contract.
Equidistant.
The official residence of a consul.
Food consumed.
A pronoun.
A beverage.
A period of time.

A M Y
W A R
O R E
A T E
C O N V I N C E D
I N D E N T U R E
P A R A L L E L S
C O N S U L A T E
A T E
S H E
T E A
E R A

The central letters give the name of a reformer—Martin Luther.

CRYPTOGRAPHY.

THIS word, being derived from the Greek, "cryptos," a secret, and "graphein," to write, almost explains itself.

Cryptographs are formed by a substitution of one letter for another throughout a sentence, or by using figures, signs, &c., in the place of letters. Cryptography as a science is supposed to enter largely into State diplomacy, secret correspondence being maintained by its means with the various State officials scattered over the globe. In the commercial world it is a fact that such correspondence is transmitted by telegraph with much saving of labour and money and with perfect secrecy, each correspondent possessing a key which enables him to translate into plain words and sentences the otherwise unintelligible jumble of signs. The "agony column" of the daily papers often contains specimens of cryptographic writing, most mysterious to the general reader, but plain to those for whom they are intended. It is, however, as a means of amusement that Cryptography here finds a place.

The first requisite is to provide ourselves with a key. The following will serve as an example :—

A. B. C. D. E. F. G. H. I. J. K. L. M. N. O. P. Q. R. S. T. U. V. W. X. Y. Z.
8. z. w. t. 3. a. r. v. 4. p. n. m. l. a. 5. e. i. o. u. f. 2. h. 6. g. x. d.

Shakspeare's "Seven Ages" will then read thus :—

8mm fv3 65omtu 8 uf8r3,
8at 8mm fv3 l3a 8at 65l3a l3o3mx em8x3ou.
fv3x v8h3 fv34o 3g4fu 8at fv34o 3afo8aw3u,
Sat 5a3 l8a 4a v4u f4l3 em8xu l8ax e8ofu,
v4u 8wfu z34ar u3h3a 8r3u.

In order to save the trouble of reference—though doubtless the noble passage

is familiar to many readers—we may as well quote the lines of which the foregoing is the Cryptograph:—

“All the world's a stage,
And all the men and women merely players:
They have their exits and their entrances;
And one man in his time plays many parts,
His acts being seven ages.”

In the solution of this and kindred puzzles the student should examine very carefully to find out the letters, figures, or signs that most often recur—they will be found to stand for *t*, *s*, and the vowels, and as soon as these letters are discovered the translation is easy. We will vary the key, and still this suggestion will hold good.

A.	B.	C.	D.	E.	F.	G.	H.	I.	K.	L.	M.	N.	O.	P.	R.	S.	T.	U.	V.	W.	Y.
e.	k.	w.	m.	t.	h.	c.	o.	a.	s.	r.	f.	s.	l.	i.	y.	d.	n.	h.	j.	p.	g.

A few lines from Byron's "Childe Harold" will then read thus:—

Notflysadhieceasnotmtpgfiys,
Panokytencerrawtadtesmpanowottserkrilf.
Rehcoasnotwrlhndepegpanoiregbhrdwlys,
Eamrajascedabteynqwlaneas'malnlfk,
Eamcripascasnlmeg.

It will, for reasons already given, be satisfactory to print the original lines from the "Pilgrimage":—

“The morn is up again, the dewy morn,
With breath all incense, and with cheek all bloom,
Laughing the clouds away with playful scorn,
And living as if earth contain'd no tomb—
And glowing into day.”

CHRONOGRAMS.

A CHRONOGRAM is a sentence or inscription in which occur words, containing, as initial letters or otherwise, letters that represent the Roman numerals. In some chronograms the initial letters only are counted as forming the solution of the puzzle, but in others all the letters contained which may be used as Roman numerals are taken into account. History supplies us with many first-rate chronograms; in fact, it was once the custom to strike medals with chronogrammatic sentences, in which the date of the occasion commemorated was set forth by the initial letters of the superscription.

Queen Elizabeth died in the year 1603, and the following chronogram relating to that event has come down to us:—

“My Day Is Closed In Immortality.”

The initial letters of this sentence are $\underset{1}{M} = 1000$; $\underset{2}{D} = 500$; $\underset{3}{I} = 1$; $\underset{4}{C} = 100$; $\underset{5}{I} = 1$; and $\underset{6}{I} = 1$; or, $\text{MDCIII} = 1603$.

Gustavus Adolphus, Sweden's great hero, commemorated one of his victories,

obtained in the year 1632, by a medal on which was struck the following chrono-grammatical inscription :—

C h r I s t V s D V X ; ergo T r I V M p h V s .*

In this chronogram all the letters representing the Roman numerals have been brought into use, which arranged in the order set forth by the figures printed beneath them, read as MDC=1600; VVVV or $4 \times 5 = 20$; X = 10; and II or $1 \times 2 = 2$; or, 1632.

These illustrations afford a fair insight into the construction and design of the Chronogram proper. A few illustrations of this riddle in its more modern form now follow :—

Write one thousand down, quite plain,
Then half of two, then add again
Fifty and one's final letter;
You can then do nothing better
Than, after every evening meal,
Walk the distance I reveal.

Answer : M (1,000), I (half of two), L (fifty), E (one's final letter)—MILE

“After supper walk a mile.”—*Old English Proverb.*

Puzzle.

A famous English warrior duke,
Whose battles are renowned ;
A celebrated admiral,
Who first the globe sailed round ;
A navigator who was killed
By savage treachery ;
A noted voyager who first
America did see ;
A sailor second in command
In great Trafalgar's fight ;
The vessel in which Nelson fell,
In his struggle for the right.

Answer.

} MARLBOROUGH.
}
} DRAKE.
}
} COOK.
}
} CABOT.
}
} COLLINGWOOD.
}
} VICTORY.

The initials of these six words take,
And place them side by side ;
Then they will name, as thus arranged,
The year when Nelson died.

Answer : M = 1,000 ; D = 500 ; CCC = 300 ; V = 5 ; or, 1805.

To half-a-dozen add six, and to the result add five hundred. The whole will represent a word signifying clear, lucid, bright, or glowing.

Answer : (Half-a-dozen), VI ; (six), VI ; (five hundred), D ; or, V I V I D ; or, Vivid.

Puzzle.

A poet who in blindness wrote
His work of greatest fame ;
Another who, in Charles's reign,
Did make himself a name ;
Then he who's often Father called
Of English poetry ;
The far West claims this modern bard,
So rich in symphony ;
The scolding wife of Socrates,
Her name you surely know ;
The Prince of Latin poets last,
We call on you to show.

Answer.

} MILTON.
}
} DRYDEN.
}
} CHAUCER.
}
} LONGFELLOW.
}
} XANTIPPE.
}
} VIRGIL.

* English reading :—“Christ our leader : therefore victorious.”

The initials of these names you'll find
In order written down,
Will give the date in which the Plague
Did rage in London town.

Answer : MDCLXV ; or, 1665.

If from five you take five, you may leave a word denoting contempt or dislike.

Answer : FIVE ; V (or 5) taken away, leaves FIE, or fie !

One thousand two hundred and nothing and one,
Transposed, give a word expressive of fun.

Answer : M (one thousand), CC (two hundred), O (nothing), I (one) = MCCOI ; or, COMIC.
3 5 1 2 4

A thousand and fifty and one transpose,
'Twill produce a fruit in Spain that grows.

Answer : M (a thousand), L (fifty), and ONE ; or, MLONE transposed.
1 3 4 5 2

LOGOGRAMS.

As its name implies, a logogram is a puzzle in which a word is made to undergo several transpositions, by the addition, subtraction, reversion of order, or substitution of a letter or letters.

To Lord Macaulay we are indebted for some of the choicest specimens of this class of word puzzling. One of his logograms has been selected, and is given here, because it so clearly displays all the peculiarities of this class of riddle, and because it is also such a marvel of ingenuity and skill, and at the same time is so happily expressed.

" Cut off my head, how singular I act !
Cut off my tail, and plural I appear ;
Cut off my head and tail—most curious fact !
Although my middle 's left, there's nothing there !
What is my head, cut off ? A sounding sea !
What is my tail, cut off ? A flowing river !
Amid their mingling depths I fearless play,
Parent of softest sounds, though mute for ever."

The answer is, Cod ; and every line reveals a fresh play upon the word. Cut off its head, and it is *od* (odd), singular ; its tail, and it is plural, *Co.* (the abbreviation for Company) ; cut off its head and tail, and it is *O* (nothing) ; the head cut off, is a sounding Sea (*C*) ; its tail, a flowing river—Dee (*D*). Amid their (the sea and the Dee) depths the *Cod* may play, parent of softest sounds (the air bladder of the cod, a favourite delicacy to many), yet mute for ever.

Charles James Fox, the history of whose early life has been written by Sir George Trevelyan, is to be credited with the following clever logograph :—

" What is pretty and useful, in various ways,
Though it tempts some poor mortals to shorten their days ;
Take one letter from it, and then will appear
What youngsters admire every day in the year ;
Take two letters from it, and then, without doubt,
You are what that is, if you don't find it out."

Answer : Glass, Lass, Ass.

Our next example is rather a long one, but claims a place of honour wherever logograms are treated. This was also written by Lord Macaulay.

"Come, let us look close at it : 'tis a very ugly word ;
One that should make us shudder whenever it is heard ;
It may not be always wicked, but it must be always bad,
And speaks of sin and suffering enough to make one sad.
Folks say it is a compound word, and that is very true ;
But then they decompose it, which of course they're free to do.
But why of the twelve letters should they take off the first three,
And leave the nine remaining, as sad as they can be ?
For while they seem to make it less, in fact they make it more,
And let the brute creation in, that was left out before.
Let's see if we can't mend it ; 'tis possible we may,
If only we divide it in some newer-fashioned way.
Suppose, instead of three and nine, we make it four and eight ;
You'll say, 'Twill make no difference—at least, not very great.'
Yet only see the consequence ; that's all that needs be done
To change the weight of sadness to unmitigated fun.
It clears off swords and pistols, conscriptions, bowie knives,
And all the horrid weapons by which people lose their lives.
The native voice of merriment's compressed into one word,
Which chases away sorrow whenever it is heard.
Yes, four and eight, my friends, let that be yours and mine,
Though all the host of demons may exult in three and nine."

Answer : Man-slaughter, Slaughter, Man's-laughter.

The next specimen we give is by William Pitt, first Earl of Chatham.

"To discover the name that my verse would express
A letter you'll first from the alphabet guess ;
Which letter, by this may be easily known,
Its shape is the very reverse of your own.
My next, if a fair one too rashly exposes
A beauteous complexion of lilies and roses,
What the beams of the sun will infallibly do
To deaden their lustre and sully their hue.
Add to these, what induces the amorous swain
To persist in his vows, though received with disdain.
These, joined all together, will make up the name
Of a family known in the annals of fame."

Answer : S-tan-hope (Stanhope).

Robert B. Brough, the dramatist, was in early life most sensitive to criticism, and gave vent to his spleen in this somewhat bitter logogram :—

"Cut off my head, and you will quickly see
Something disliked by you and me ;
Cut off my tail, and then it is clear
The past of a verb will quickly appear ;
Cut off my head and my tail also,
You'll have a conjunction then, I trow.
Whole, I'm an insect, not over clean,
Dreaded at picnics in meadows green ;
To critics, to publishers, intimate friends,
My name a most delicate piquancy lends ;
When they smile in their guile, and hiss as they sing,
And hide under flatteries a venomous sting."

Answer : Wasp, Asp, Was, As.

The following words will be found suitable for use in puzzles of this nature, but the list may easily be extended :—

Span. (Snap, spa, asp, pan, nap.)
 Lady. (Lad, day, lay.)
 Angel. (Angle, glean, leg, glen, lane, gale, Lea.)
 Degrade. (Grade, dare, dear, ear, are, dad, gear.)
 Legate. (Eaglet, eagle, gale, lag, gat, get, let.)
 Copper. (Pope, Poe, Po, core.)

METAGRAMS.

THIS riddle is formed by changing the initial letter of a particular word again and again, so as to produce as many words as possible of different meanings. Our first example affords a good illustration of the process to be pursued.

Well known to all as a covering for the head.	Cap.
Change my initial, a doze I mean instead.	Nap.
Once more, and an opening you will see.	Gap.
Exchange again, I'm found inside a tree.	Sap.
Once more, I mean then to befall.	Hap.
Again, I'm used by travellers, one and all.	Map.
Again, in this my mother often nursed me.	Lap.
Exchange again, and this my food would be.	Pap.
Again, and a sharp blow you've spelled.	Rap.
Once more, and a blow that's hardly seen or felt.	Tap.

The following clever Metagram is from the pages of the "Modern Sphinx," a book which contains upwards of a thousand different examples of the various kinds of riddles and puzzles in existence :—

There's a word, you'll agree, commencing with B	} BOWER.
That expresses a cool pleasant shade ;	
But remove letter B and substitute C,	} COWER.
Apprehensively shrinking 'tis made ;	
Take away letter C, replace it by D,	} DOWER.
It will name what's bestowed on a bride ;	
Now if D is erased and by G replaced,	} GOWER.
A Welsh word, meaning crooked, is spied ;	
Thus far very well, now substitute L,	} LOWER.
We are going down now you will say ;	
Letter L shall be gone, and M be put on,	} MOWER.
There's a man cutting grass to make hay ;	
But when M shall have fled put P there instead,	} POWER.
It will name what is mentioned of steam ;	
Pray just now P erase, put R in its place,	} ROWER.
There's a man gliding down with the stream ;	
But now take R away, put S there, we say,	} SOWER.
That a farmer at work then it names ;	
If for S you put T you surely will name	} TOWER.
A noted place close by the Thames.	

The following is a good specimen metagram :—

Of letters four, I do denote
 A man of wisdom great,
 But cooks do often me devote
 To share—alas !—a goose's fate ;

But change my head, and then, instead,
 Part of a book you'll find ;
 And if again I'm carefully read,
 A youth who walks behind ;
 Change once again, and then you will
 A furious passion see,
 Which reason vainly tries to still,
 Keep far removed from me ;
 Another change, and you will then
 See I'm remuneration
 Earned by all grades of working men
 Throughout the British nation ;
 But change my head once more, and then
 A prison I appear,
 From which sweet sounds oft issue forth
 That pleasant are to hear.

Answer: SAGE. PAGE. RAGE. WAGE. CAGE.

Below is a list of some words suitable for Metagrams, together with the various changes which each word allows:—

Bear, Tear, Lear, Gear, Wear, Hear, Pear. Year, Rear, Fear, Scar, Dear, and Near.
 Book, Cook, Hook, Look, Nook, Rook, Took.
 Waste, Taste, Paste, Caste, Basta.
 Bine, Fine, Kine, Dine, Line, Mine, Nine, Pine, Vine, Wine.
 Bound, Found, Hound, Mound, Pound, Round, Sound, Wound.
 Cork, Pork, Fork, York.
 Dame, Fame, Game, Came, Lane, Name, Same, Tame.
 Oake, Lake, Rake, Sake, Take, Wake.
 Tent, Rent, Lent, Kent, Dent, Cent, Bent.
 Vast, Mast, Last, Fast, Cast, Past.
 Heather, Feather, Leather, Weather.
 Palter, Falter, Salter, Halter.
 Basket, Casket, Gasket.

WORD CAPPING.

WORD puzzles under this name are to be found in some old riddle books, but such puzzles are now usually known as Metagrams, and have been here described under this the more modern name. (See previous page.)

PARAGRAMS.

THE meaning of Paragram is a play upon words, otherwise a pun, a paragrammatist and a punster being convertible terms. The word Paragram may further be explained as a word or phrase which admits of a double meaning, the effectiveness of which consists in the incongruity and consequent humour caused by the word or phrase being used in totally different senses to that customarily attributed to it. Punning is only effective when impromptu, and can hardly be classed among the social round of word puzzles; but, on the other hand, Paragrams may be constructed which bring out the different meaning of the same word, giving rise to the exercise of ingenuity, and at the same time affording fun and amusement. The following illustrations will show in what

the peculiarity of Paragrams consists, and how far superior as a puzzle Paragrams are to mere puns :—

I strengthen the weak, I cross the wide sea,
I frighten the thief, and I grow on a tree.

Answer : BARK.

I am a letter and a word,
I am a tree and Christian name ;
And should you me in pieces cut
Yourself and act would be the same.
Weigh this with care, and then no doubt
You'll find its simple meaning out.

Answer : U. YOU. YEW. HUGH. HEW.

EXTRACTIONS.

As its name implies, this novel and interesting logogram is formed by extracting from sentences the letters of a word which has been chosen as the key to the word puzzle. Its method of construction may be thus simply explained. A certain word is to be selected, and from the letters only which compose that word, but repeated as often as found necessary, an expression of an idea or ideas is to be evolved in one or more sentences. The peculiarity of "Extractions," wherein they differ from other logograms, will be found in the ingenuity and skill necessary to be displayed in the choice of a suitable word, and more particularly in the composition of the diction, in which the letters of that word shall appear.

The following illustration shows how a sentence may be constructed, solely with the letters which make up the name of an English county :—

1. A great nation is sometimes the gainer in not resorting to arms against its enemies tho' their aim is to mar its interest.—Nottinghamshire.

The puzzle is, of course, to discover the name of the county.

This puzzle may be modified by infusing a clue to its solution in the insertion of words *underlined*, which are made up of letters not all comprised in the key word, thus affording a ready means of discovering the letters which are to be discarded in the search, and it answers also another good purpose in affording the riddler more scope in composing his sentences.

Amongst the many illustrations of this style of presentment which have come under our notice we have selected the following amusing one as an example :—

2. Once in a museum *at Milan with my uncle Ormond and cousins Malcolm, Samuel, Simeon, Susan, Anne, Emma, and Ellen, I saw in succession, a lion, a mule, an ass, a mole, a seal, a mouse, and some other animals ; also, a small case of snails which I could smell with my nose. — The same noon, we had a nice social meal at an Inn, a clean menial serving us with essence of cocoa, luscious melons, salmon, soles, ale, and moselle ; and we had a musician to amuse us. — The letters comprising the words not printed in italics are to be found in a single word. What is it? Answer. — "Miscellaneous."*

TRANSPOSITIONS.

TRANSPOSITIONS differ from Anagrams only in the fact that the letters from the word or words selected are not formed into a sentence or other words. For example :—

A Book and its Author.—Trdhsedstotevlfwinalohrchttyehocfutoceeseo by Eascepink tap.—which being interpreted reads, What led to the Discovery of the Source of the Nile, by Captain Speke.

An Author and his Work.

Accdeehiklnrs	Charles Dickens.
Abocahiikllnosy	Nicholas Nickleby.
Arabbdegurny	Barnaby Rudge.
Acdddeefilopprv	David Copperfield.
Acceehiikpppratwk	The Pickwick Papers.
Cdehhiiloooprasttuy	The Old Curiosity Shop.

A more interesting form of this puzzle is now shown, in the shape of well-known proverbs changed into other sentences.

A rolling stone gathers no moss.
 Strong lion's share almost gone.
Time and tide wait for no man.
 I don't admit women are faint.
Birds of a feather flock together.
 It rocks, the broad flag of the free.

But as these proverbs are changed into sentences, they come more properly under the heading of Anagrams. They are given here, however, as in some circles they will be more familiarly known as Transpositions rather than as Anagrams.

DEFINITIONS.

THE proposition to define "Definitions" becomes in itself almost a play upon words, but we may explain that though "Definitions" cannot properly be classed under riddles or word puzzles, yet they are so much akin to them that they claim a place here, with "Fireside Fun," and will be found useful as a means of providing amusement. This game will necessitate the use of a table, paper, and pencil or pen and ink. One of the company proposes a word for definition, and it is for the rest of the company to write down their idea of the same in a terse, epigrammatic, poetic, or humorous manner.

A few specimens will illustrate our meaning. Let us suppose the word *Hypocrite* to have been chosen, and the following definitions of the word to have been given in: the definitions should then be read aloud by some one of the company selected for the purpose.

"He who strives to seem and not to be; to whom reputation is everything, character nothing."

"A social spoon of polished gilt, in whom it is only possible to discern distorted reflections of the truth."

"One who wears virtue's livery for the sake of her wages, without any intention of doing her work."

"One who assumes what he has not; a showman who by a startling outside picture screens the barrenness of the entertainment within."

"Like a sugar-coated pill, he seeks to hide his true character under an artificial coating."

Again, as a contrast, take *Hero* as the selected word to be defined—

"One whose law is love; whose master, duty; whose armour, courage, faith, and hope; and who seeks not glory."

"A victor over Self—the hardest and the noblest conquest of all, but one for which the world has no laurel wreath."

"A nobleman of Nature, who has seized his opportunities and displayed the attributes of his race."

"The true hero is the champion of truth, the servant of right, the ruler of himself, and the sworn foe of all that is ignoble."

"He who for others sacrifices Self."

"He who fears nothing but his own disgrace."

"He who is stronger than his fellows, and makes his fellows stronger by his strength."

A Coward.

"One who does both good and evil at the bidding of fear."

"He who puts honour in peril, to take himself out of peril."

"One who has stopped the ear of manliness with the cotton-wool of Self."

Pleasure.

"The emotion we feel after doing a great and noble action."

"A Will o' the wisp, ever pursued but never overtaken."

"A false coin, passed off as happiness."

"The leader of folly."

"The sure accompaniment of wisdom."

Many of the above definitions will be recognised as well-known quotations

Other subjects may be started, such as:—*Progress—Rivalry—Nonsense—Nothing—Thanks—Regards—Vanity—Ridiculous*, and the game may be varied by combining several of these, and forming sentences in which each word shall have its due place, as "*Vanity* is a disease which preys upon all the good qualities in the human system, reduces them to an aspect *ridiculous* in the extreme, and precludes all ideas of mental *progress*," or, "*Nothing* gives *pleasure* in successful *rivalry*, if the victory is not honestly won."

INVERSIONS.

CHANGE of order, a turning backward, is the dictionary meaning of this term, and clearly explains the method by which this simple puzzle is constructed.

"Inversions" belong to the same genus as the Logogram, which has been fully described, but have their own peculiarities, as the following examples will plainly show:—

Two letters which express a superfluity.
Inverted name a famous Eastern County.
Answer : XS (Excess). SX (Essex).

Invert a title common in Spain
A mark of recognition you obtain.
Answer : Don, Nod.

Invert a colour, quiet, staid,
A term for Poet you have made.
Answer : Drab, Bard.

Invert a sliding box in case or table,
You'll find a recompense—it is no fable.
Answer : Drawer, Reward.

A portion if 'tis backwards read
Will prove to be a snare instead.
Answer : Part, Trap.

HIDDEN WORDS.

THIS puzzle is very similar in principle to many of the other word puzzles previously described; but in that it has peculiarities and merits of its own, we give it a place by itself. It is like in many respects to the old-fashioned word

puzzle known as "Discoveries," indeed, "Hidden Words" is a modification of and an improvement upon "Discoveries." In the older and now almost obsolete puzzle, it was the practice for the riddler to propound some sentence in which certain words might be made by piecing together here and there certain letters or combinations of letters formed in the sentence, and which letters, when duly pieced together, would give the designation of some person or persons, place or places, or other object. The following is an illustration of the puzzle in question, and for the better information of the reader the letters to be discovered have been printed in italics; in the actual puzzle, however, it is to be understood that the letters to be discovered are not to be marked in any manner different from the remainder of the text.

Example: Find the name of a great warrior, and a battle he fought, in the following sentence:—

You are looking quite *well* since you came from Brighton; no doubt the fresh air and sea *water* were very beneficial to you.

Answer: Wellington, Waterloo.

In the modification of this puzzle, which we here treat under the title of "Hidden Words," the practice is to so construct the sentence from which the hidden word is to be picked out, that all the letters forming the word shall be found consecutively and in their proper order. Greater care has, consequently, to be exercised by the proposer of the riddle, while, at the same time, the difficulty of guessing the answer remains sufficient to make the task worth attempting. The few illustrations following will be useful as examples of the nature of the puzzle. The letters out of which the hidden word is composed are printed in italics, to make the object of the puzzle clear to all:—

I at once rowed *over* to the opposite side of the river.

The hidden word is the name of a seaport town in England, a fashionable sea-side resort, and a military depôt.

Answer: Dover.

Fear nothing from me, I have no wish to harm you.

Hidden word is the name of a river in Italy.

Answer: Arno.

Hush, *Ann*, only you need go.

The name of one of the largest and most historically celebrated rivers in the British Isles.

Answer: Shannon.

Is it *ham*, especially cooked for me?

Another large and famous British river.

Answer: Thames.

I thought it was *capital*, your rendering of the character of Iago.

The name of a country of Europe.

Answer: Italy.

Will I amuse the remaining guests?

A Christian name.

Answer: William.

In the construction of a riddle, acrostic, word-puzzle, or *enigma*; *caul*, *aygreen*, and words like these, and which are but rarely employed, are useful for mystification.

The name of a celebrated essayist and historian.

Answer: Macaulay.

The puzzle of "Hidden Words" is sometimes described under the names of "Hidden Cities," "Hidden Rivers," "Hidden Poets," "Hidden Countries, Battles, Events," and the like.

NUMBERED CHARADES.

THE "Numbered Charade" is a species of conundrum, simple in its construction, but possessing enough point to rivet the attention of all the company as to its probable meaning. It possesses, too, a distinguishing characteristic over other riddles, in the contagious influence it exercises upon all seeking its solution. The riddler's quick wit, set to work to solve a good Charade, may possibly fail in that attempt; but assuredly the task itself will suggest ideas of words and their arrangement which he may, in his turn, announce to the social circle, and thus "keep the ball rolling." This accounts for the great favour in which Charades are held as a popular source of amusement.

A Charade is an enigmatical composition which describes an object; the name of this object should be composed of two or more syllables, each syllable having a separate and different meaning. In announcing the Charade, which may be written in prose or verse, it must be divided into my *first* (first syllable); my *second* (second syllable); my *third* (if there are more syllables than two); and my *whole*, which should signify the name of the object of the puzzle. With this explanation we shall present to our readers a selection of examples, old and new.

A poetic Charade, by Winthrop Mackworth Praed, has much merit, and is noted for the length of time it remained undiscovered. Miss Mitford, in her "Literary Recollections," confesses her inability to solve it, which was shared by all to whom she had propounded it.

"Sir Hilary charged at Agincourt;
Sooth! 'twas an awful day!
And though, in that old age of sport,
The rufflers of the Camp and Court
Had little time to pray,
'Tis said that Sir Hilary muttered there
Two syllables by word of prayer.
My *first*, to all the brave and proud,
Who see to-morrow's sun.
My *next*, with her cold and quiet cloud,
To those who find their dewy shroud
Before the day be done.
And both together, to all bright eyes,
That weep when a warrior dies."

The *answer* is supposed to be GOOD NIGHT; *good* for those who survived; *night*, "with her cold and quiet cloud," falling on the dead; and a good-night to the fair dames who wept for them.

The following amusing four lines of doggerel verse were composed by Mr. Mark Lemon. They fulfil all the requirements of the Charade, and will be appreciated as a slight souvenir of that master of humour, who so long edited the pages of *Punch*:—

Old Charlie Browne, who a big rogue was reckon'd,
Was brought up at my *first* for making my *second*.
He was fined, and because he no money would pay,
Had to work with my *whole* on the Queen's highway.

Answer: Barrow (Bar-Row).

The eminent statesman, George Canning, is responsible for our next.

Though weak to a proverb my *first* has been reckoned,
The game is so constantly made of my *second*;
Yet, to hosts without number, my *whole* bade defiance,
And the world stood amazed at the beauteous alliance.

Answer: Waterloo (Water-Loo).

Archbishop Whately thus tersely arranges our next :—

My *first* is equality, my *second*, inferiority ; my *whole*, superiority.

Answer : Peerless (Peer-Less).

Charles James Fox, amidst all the cares and anxieties surrounding a great Parliamentary leader, found time to indulge his vein of pleasant humour in this fascinating pastime. The following was his composition :—

My *first* is expressive of no disrespect,
But I never call you by it when you are by ;
If my *second* you still are resolved to reject,
As dead as my *whole* I shall presently lie.

Answer : Herring (Her-Ring).

The following miscellaneous charades will further explain the great variety of these puzzles, may in themselves afford amusement, and will be useful as models on which other charades may be formed. If, unlike the preceding, they can claim no particular literary merit, it is to be hoped that, as helping forward "Fireside Fun," they will be none the less welcome.

Ride on, ride on, thou traveller bold,
And cast thy looks on *first* ;
See how the tempest clouds do lower,
That soon in storm shall burst.
Ride on, ride on, thy *second* leads
Across the lonely heath,
Where gibbets tell of darksome deeds,
And culprits swing beneath.
Ride on, ride on, my *third* thou art
An honest one and true ;
Beware ! a *third* is lurking near,
Who would his hands imbrue.
Ride on, ride on, ride for thy life,
Spur on thy faithful steed,
For now my *whole* thy *second* bars,
Nerved for his lawless deed.

Answer : Highwayman.

Safe on my fair one's arm my *first* may rest,
And raise no tumult in a lover's breast.
My *second* does the want of legs supply,
To those that neither creep, nor walk, nor fly.
My *whole* 's a rival to the fairest toast,
And when it's most admired, it suffers most.

Answer : Muffin (Muff-Fin).

My *first* is near the dear bright sea,
The green waves oft it lave ;
It glitters in the sunshine,
Lies in the deep dark cave.
My *second* is quite endless,
Like the love of which it tells,
A bright idealisation
Of Love's eternal spells.
My *third*, alas ! to say the truth,
Suggests a vacant sty.
My *whole*, a royal residence ;
Now, prithee, tell me why.

Answer : Sandringham (Sand-Ring-Ham)

My *whole* is the very reverse of my *second* ;
 My *first* for refreshment is used ;
 And those who have wasted their gifts in my *whole*,
 The talents they have, have abused.

Answer : Inaction (Inn-Action).

My *first* 's the gift of Mother Eve ;
 My *next* 's as old as Adam.
 Joined, if my meaning you perceive,
 Your humble servant, Madam.

Answer : Woman (Woe-Man).

I sent my *second* to my *first*, but many a *whole* passed before I saw him again.

Answer : Season (Sea-Son).

I put up my *second* round my legs, swept up my *first*, and put my feet on my *whole*.

Answer : Hearthrug (Hearth-Rug).

My *first* should be my *second*, but I would not be my *whole*.

Answer : Beardless (Beard-Less).

My *first* monopolises Dublin's busy highways ; my *second* is Love's favourite epithet ;
 my *whole* in drawing-rooms is always found.

Answer : Carpet (Car-Pet).

Britannia rules my *first* by means of my *second*, in spite of every caprice of my *whole*.

Answer : Seasons (Sea-Sons).

My *first* I hope you are, my *second* I see you are, and my *whole* I know you are.

Answer : Welcome (Well-Come).

My *whole* is under my *second*, and surrounds my *first*.

Answer : Waistcoat (Waist-Coat).

My *first* gave us early support ; my *second* is with virtues endowed ; and my *whole* is to
 be found near a farmhouse.

Answer : Milkmaid (Milk-Maid).

LETTER OR FIGURE CHARADES.

IN this description of Charade a word is selected and so arranged that other words may be formed with the different letters. The same letters may be repeated ; but care should be taken that every letter forming the Charade word be employed. Thus, the word "Telegraph" being chosen, may be arranged in the following manner, and the Charade be propounded as follows :—

I am a word of nine letters : ^amy 1, 2, 7 is a Chinese plant ; ^bmy 5, 6, 7, 1, 2 is a fire-side requisite ; ^cmy 5, 6, 2, 7, 1 signifies vast ; ^dmy 5, 6, 7, 8, 4 is the name of a luscious fruit ; ^emy 9, 4, 7, 1 signifies warmth ; ^fmy 8, 4, 7, 6 is the name of a fruit ; ^gmy 1, 4, 7, 6 signifies to rend ; ^hmy 6, 4, 7, 8 must be done with corn previously to gathering it in ; ⁱmy 5, 7, 1, 9, 2, 6 is to collect ; ^jmy 8, 2, 4, 3 is to pare ; ^kmy 7, 3, 2 is the name of a malt liquor ; ^lmy 9, 7, 3, 4 means hearty ; ^mmy 7, 8, 4 is an animal ; ⁿmy 9, 4, 7, 3 is to cure ; ^omy 3, 4, 7, 8 is to jump ; ^pmy 3, 4, 5 is the name of a human limb ; ^qmy 2, 4, 3 the name of a fish ; ^rmy 1, 6, 7, 8 is the name of an article used to catch vermin ; ^smy 8, 4, 7, 3 is to ring ; and ^tmy whole is a marvellous invention.

Answer : ^aTea ; ^bgrate ; ^cgreat ; ^dgrape ; ^eheat ; ^fpear ; ^gtear ; ^hreap ; ⁱgather ; ^jpeel ; ^kale ; ^lhale ; ^mape ; ⁿheal ; ^oleap ; ^pleg ; ^qeel ; ^rtrap ; ^speal ; ^tTELEGRAPH.

One other example of Letter Charades is given, in order to show the vast number of words that can be produced from the letters of one single word :—

I am a word of eight letters: *a* my 4, 3, 5, 6, 8 is significant of eminence; *b* my 7, 5, 6, 8 is tidy; *c* my 3, 6, 4, 1 are untidy; *d* it is necessary to frequently practise my 5, 6, 8; *e* my 7, 5, 6, 3 is not distant; *f* my 1, 5, 6, 8 is a place of rest; *g* my 1, 5, 3, 4, 2 is the name of a woollen article; *h* my 4, 2, 6, 3 is accoutrements; *i* my 4, 6, 8, 5 is an entrance; *j* my 1, 5, 8 is to fix in position; *k* my 1, 2, 3, 5 is dry and withered; *l* my 1, 2, 6 is where *m* my 8, 6, 3, 1 live, and *n* where bad boys are 1, 5, 7, 8; *o* we don't like to 1, 2, 5 the man call for the *p* 3, 2, 7, 8 and *q* 3, 6, 8, 5, 1; *r* my 7, 5, 8 is used by fishers; *s* my 8, 5, 7 is a number; *t* my 7, 5, 1, 8 is built in spring; *u* my 3, 2, 1, 8 is needful; *v* my 3, 6, 8 is vermin; *w* my 6, 7, 8 is an insect; *x* my 7, 6, 4 is a useful animal; *y* my 5, 6, 3 is part of the human body; *z* my 8, 5, 6, 3, 1 is a sign of sorrow; *aa* my 1, 2, 6, 3 is to burn, and *bb* my *whole* is an officer of the army.

Answer: *a* Great; *b* neat; *c* rags; *d* eat; *e* near; *f* seat; *g* serge; *h* gear; *i* gate; *j* set; *k* sere; *l* sea; *m* tars; *n* sent; *o* see; *p* rent; *q* rates; *r* net; *s* ten; *t* nest; *u* rest; *v* rat; *w* ant; *x* nag; *y* ear; *z* tears; *aa* sear; *bb* SERGEANT.

VERBAL CHARADES.

A VERBAL CHARADE is a word made up of letters, one of which is contained in each of different specified words. The following example will clearly set forth the peculiarity of this Charade. In the example, the letters forming the Charade word are printed in italics :—

My first is in lamb, but is not in sheep;
My second in shallow, but is not in deep;
My third is in rat, but not in a mouse;
My fourth is in villa, but not in a house;
My fifth is in love, but is not in hate;
My sixth in a door, but not in a gate;
My seventh's in plant, but not in a tree,
And now my all a Christian name you'll see.

Answer: MATILDA.

Of "Verbal Charades," the above specimen will be sufficient. Puzzles of this nature are evidently easily made, and from the construction of them by using suitably contrasted words as in the above example, considerable fun and amusement may be derived.

ACROSTICS.

AN "Acrostic" is a composition in verse, in which the initial letter of each line, taken in order, forms the name of a person, or of some motto which is the subject of the composition. In the expression of good wishes to friends and relatives, on birthdays and other festive occasions, the "Acrostic" finds an appropriate place; but in this collection of word puzzles we prefer to deal with that form of "Acrostic" which presents opportunities for the exercise of skill and ingenuity to the riddler. This will be found in the "Double Acrostic," and other forms to be mentioned.

The Double Acrostic may be written either in prose or verse, the condition being, that the initials and finals of the words to be guessed make two names or two words of definite and different meanings.

The Prose Double Acrostic is the more simple form, and our first example will be that known as

The "*Windsor*" Double Acrostic, written by Queen Victoria for the amusement of her children. It may interest riddlers to know that Her Majesty and the late Prince Consort found much pleasure, and were exceedingly clever in the construction of this kind of riddle:—

1. A city in Italy. 2. A river in Germany. 3. A city in the United States. 4. A town in North America. 5. A town in Holland. 6. The Turkish name for Constantinople. 7. A town in Bothnia. 8. A city in Greece. 9. A circle on the globe.

Read the *initials* downwards, and they form a town in the North of England: the *finals* read upwards indicate what that town is famed for.

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1. N   A   P   L   E   S
2. E       L       B       E
3. W A S H I N G T O N
4. C I N C I N N A T I
5. A M S T E R D A M
6. S T A M B O U L
7. T   O   R   N   E   A
8. L   E   P   A   N   T   O
9. E   C   L   I   P   T   I   O

```

The answer is—"Newcastle," "Coal Mines."

When verse is employed, it is usual to convey the sense of the whole in a couplet, preceding the description of the syllables, thus:—

'Tis murmured in the last adieu,
When looks are sad, and words are few.

1. The pleasure of a lawyer's life,
In deeds and wills the cause of strife.
2. A fruit in orchards often seen—
In pies and puddings, too, I ween.
3. Who treads the light fantastic toe
Must like this merry dance, I know.
4. My fourth and last you'll find to be
A nobleman of high degree.

Answer: Fare Well. ¹ FlaW, ² ApplE, ³ ReeL, ⁴ EarL.

It is, however, quite unnecessary to supply further examples of this interesting form of Acrostic. The foregoing instances clearly explain the principle of the amusement. It will be obvious that an ingenious riddler has almost endless opportunities of distinguishing himself, not only by the quaint devices to which his imagination may give rise, but also by the excellence of the verses in which they may be expressed. Some difficulty will probably be found in making the Acrostics sufficiently intricate to excite the curiosity and perseverance of the young students, or to sustain the interest of the company indulging in this species of "Fireside Fun," but experience will soon remedy that defect.

A few examples of the simple prose Double Acrostics may prove serviceable in initiating our readers into the mysteries of this word puzzle, and to this end the following are selected:—

1. A defamatory satire. 2. A town in Portugal. 3. A word poetically endowed "with its thousand ears." 4. A wood nymph. 5. Severe pain in the inward parts. 6. Name of a political party in the State. 7. A creeper. 8. A mask. 9. A title.

The initials and finals form the names and titles of two of Britain's heroes, both of whom derived fame from exploits achieved in India.

1. L I B E L
2. O P O R T O
3. R U M O U R
4. D R Y A D
5. C O L I C
6. L I B E R A L
7. I V Y
8. V I Z A R D
9. E S Q U I R E

Answer : Lord Clive, Lord Clyde.

1. A city of Lombardy. 2. Signifying unfinished. 3. A famous loch in Scotland. 4. An empire of Europe. 5. An eloquent speaker. 6. Signifying undressed.

The initials read downwards and the finals upwards, will reveal two celebrated poets.

1. M I L A N
2. I N C O M P L E T E
3. L O M O N D
4. T U R K E Y
5. O R A T O R
6. N A K E D

Answer : Milton, Dryden.

1. By Apollo was my first made. 2. A shoemaker's tool. 3. An Italian patriot. 4. A tropical fruit.

The initials and finals read downwards give the name of a graceful writer of essays, and the *nom de plume* by which he was first known to fame.

1. L Y R E
2. A W L
3. M A Z Z I N I
4. B A N A N A

Answer : Lamb, Elia.

1. A writer of a book prophetic. 2. Singular, but not otherwise odd. 3. A joke that does not always end in mirth. 4. A mother-in-law deeply loved by her son's widow. 5. A law, hostile to woman's rights. 6. The name of an ancient German emperor and modern king of Greece. 7. A rare old man.

The initials and finals give the name of a scholar of profound learning, and the work by which he is best known.

1. J O E L
2. O N E
3. H O A X
4. N A O M I
5. S A L I O
6. O T H O
7. N O N A G E N A R I A N

Answer : Johnson, Lexicon.

ENIGMAS.

THE Enigma hints the thing it would convey,
In terms quite various—opposite, some say,
The secret it reveals, but not so clear as day;
For in dark and mazy paths it ever loves to stray.

This jingle of four lines will convey to the reader some idea of the

peculiarities of this word puzzle. We may, however, add, that the modern enigma may be based upon a single object, word, or even a letter of the alphabet; and, like the conundrum, may be made to turn on the rare and unusual use of the word employed.

The most celebrated enigma, perhaps, is one formed on the letter H. It has for years been attributed to, and is included in the works of, Lord Byron, from a copy of which we extract it; but the belief is now prevalent that it was written by Miss Katherine Fanshawe.

" 'Twas whisper'd in heaven, 'twas mutter'd in hell,
And echo caught faintly the sound as it fell;
On the confines of earth 'twas permitted to rest,
And the depths of the ocean its presence confess'd.
'Twill be found in the sphere when 'tis riven asunder,
'Tis seen in the lightning, and heard in the thunder;
'Twas allotted to man from his earliest breath,
It assists at his birth, and attends at his death;
Presides o'er his happiness, honour, and health,
Is the prop of his house, and the end of his wealth.
In the heap of the miser 'tis hoarded with care,
But is sure to be lost in his prodigal heir.
It begins every hope, every birth it must bound,
It prays with the hermit; with monarchs is crowned;
Without it the soldier and seaman may roam,
But woe to the wretch that expels it from home.
In the whispers of conscience 'tis sure to be heard,
Nor e'en in the whirlwind of passion is drowned;
'Twill soften the heart, though deaf to the ear,
'Twill make it acutely and constantly hear;
But in short, let it rest—like a beautiful flower,
Oh, breathe on it softly, it dies in an hour."

Lord Byron did, however, compose an Enigma on the letter I, which is equally clever, but perhaps not so well known:—

" I am not in youth, nor in manhood, nor age,
But in infancy ever am known;
I'm a stranger alike to the fool and the sage;
And though I'm distinguished in history's page,
I always am greatest alone.
I am not in earth, nor the sun, nor the moon;
You may search all the sky—I'm not there.
In the morning and evening—though not in the noon—
You may plainly perceive me; for, like a balloon,
I am midway suspended in air.
Though disease may possess me, and sickness and pain,
I'm never in sorrow nor gloom.
Though in wit and in wisdom I equally reign,
I'm the heart of all sin, and have long lived in vain,
Yet I ne'er shall be found in the tomb."

The next two Enigmas are attributed to Charles James Fox.

" Formed long ago, yet made to-day;
And most employed when others sleep;
What few would like to give away,
And fewer still to keep."

Answer: A bed.

" You eat me, you drink me, describe me who can,
For I'm sometimes a woman, and sometimes a man."

Answer: A toast.

To the pen of Germany's celebrated poet, Schiller, we are indebted for the following expressive Enigma :—

" A bridge weaves its arch with pearls
High over the tranquil sea.
In a moment it unfurls,
Its span unbounded, free.
The tallest ship with swelling sail
May pass 'neath its arch with ease,
It carries no burden, 'tis too frail,
And when you approach, it flees.
With the flood it comes, with the rain it goes,
And what it is made of nobody knows."

Answer : Rainbow.

The following specimens will still further show the variations of which Enigmas are capable :—

In other days, when hope was bright,
You spoke to me of love and light,
But now you tell another tale,
That life is brief and beauty frail ;
Away, ye grieve, and ye rejoice,
In one unfelt, unfeeling voice.

Answer : Church Bells.

Enough for one, too much for two, and nothing at all for three.

Answer : A Secret.

Scorned by the meek and humble mind,
And often by the vain possessed ;
Heard by the deaf, seen by the blind,
I give the troubled spirit rest.

Answer : Nothing.

It need not be said that there is no limit to the different kinds of Enigma which may be devised for the mystification, as well as the entertainment, of a roomful of young folk. They may be quaint and humorous conceits (many of which may be found in standard poets), or the propounder of the riddle may select Enigmas which pass from "grave to gay, from lively to severe," according to the taste or desire of the company. Of course the more varied and miscellaneous these puzzles are the better, for it is just as important to keep up the interest in these quieter amusements as in those noisier games of which we have treated in another portion of this book.

ALPHABETICAL PUZZLES.

THE "Alphabetical Puzzle," though simple in its construction, affords an opportunity for the riddler, not only to display his ingenuity, but also to quicken his perception of sound. The puzzle consists in the choice of a word, the sound of which, when uttered, shall be comprised in the naming of one or more letters of the alphabet. The word chosen should then be briefly described or defined, the number of letters forming the word stated, together with the number of letters that, when uttered, give a sound similar to the sound of the chosen word, thus :

A word denoting a volume of water spelt with three letters, but that can be expressed with one.

Answer : Sea, C.

This simple example will make the above description perfectly clear ; and we now give some other examples in order to set forth the variety that may be introduced into this kind of amusement.

Words containing three letters which can be expressed in one :—

- | | | |
|-------------------|---------------|----------|
| 1. Famous gardens | Answer : Kew | |
| 2. English rivers | „ Dee and Wye | D and Y. |
| 3. A tree | „ Yew | Q.
U. |

Words containing four letters which can be expressed in two :—

- | | | |
|-----------------------|---------------|------|
| 4. An adjective | Answer : Wise | Y Y. |
| 5. A prophet | „ Seer | O R. |
| 6. Repose and comfort | „ Ease | E E. |

Words containing five letters which can be expressed in two :—

- | | | |
|---|----------------|------|
| 7. An exertion of mind or body | Answer : Essay | S A. |
| 8. Decrepitude | „ Decay | D K. |
| 9. An English county | „ Essex | S X. |
| 10. To surpass | „ Excel | X L. |
| 11. A lady's Christian name | „ Ellen | L N. |
| 12. A lady's Christian name | „ Katie | K T. |
| 13. Plural of a species of leguminous plant | „ Peas | P P. |
| 14. To lay forcible hands on | „ Seize | C C. |
| 15. Requires replenishing | „ Empty | M T. |

Words containing five and six letters which can be expressed in three :—

- | | | |
|----------------------|-----------------|--------|
| 16. A tax | Answer : Excise | X I L. |
| 17. A flower | „ Peony | P N E. |
| 18. A plaintive poem | „ Elegy | L E G. |

Words containing six and seven letters which can be expressed in two :—

- | | | |
|-------------------------|-----------------|------|
| 19. A superfluity | Answer : Excess | X S. |
| 20. A species of pepper | „ Cayenne | K N. |

Words containing six and seven letters which can be expressed in three :—

- | | | |
|----------------------|-----------------|--------|
| 21. A likeness | Answer : Effigy | F E G. |
| 22. A state of being | „ Entity | N T T. |
| 23. To pardon | „ Excuse | X Q Q. |
| 24. Dissolution | „ Decease | D C C. |

Word containing seven letters which can be expressed in four :—

- | | | |
|--------------|------------------|----------|
| 25. A malady | Answer : Disease | D D E E. |
|--------------|------------------|----------|

GUESSING STORIES.

THIS is a word puzzle entertainment, into which the riddler may, if by a judicious display of imagery, description, and humour, he only properly sets about his work, introduce much genuine amusement and fun.

The puzzle is best explained by an illustration which is given below, and which can be taken as a model on which other "Guessing Stories" may be constructed.

I am the child of the night, and the child of the day. Some dread me, some hate me, some find me a good companion. I have walked for many a mile, but no one ever heard my footfalls. Sometimes my master sends me on before him, but as he travels as quickly as I do, he sends me back sometimes, and I have to follow in the rear. I have hands and feet, head and shoulders, but no body. It is impossible to estimate my exact height. Nobody has ever looked into my eyes ; nobody has ever incurred my anger. I sometimes in my haste run over people, and am sometimes trampled under foot by them. When my master writes, I always hold a pen by his side ; and when he shaves, I generally take a razor too. I have

travelled a good deal, and am very old. When Adam walked in Eden, I, too, was there, and when any new member of Parliament goes to the House of Commons, I nearly always accompany him. Robinson Crusoe was disturbed by my approach when I visited him on the Island of Juan Fernandez ; and on one occasion I was the means of defeating an army. Although I have no eyes, I could not live without light. I am of very active habits, although I have not the will or the ability to move. Tell me my name.

Answer : A Man's Shadow.

MENTAL SCENES.

THESE are next-of-kin to "Guessing Stories," they will however be appreciated as they afford perhaps greater scope for vividly descriptive narrative.

The following specimen of a Mental Scene, which is sufficiently close to the original to reveal to all lovers of Shakspeare the play upon which it is founded, will serve as an example as to how these scenes may be rendered :—

From camp to camp, throughout the live-long night, nothing is heard but the hum of both armies. So stilly is the scene, that the opposing sentinels might almost hear each other's secret passwords. The cocks commence to crow, the armourers, with busy hammers, secure all rivets in the knights' full armour, the clocks do toll and the third hour of drowsy morning name, and all gives note of dreadful preparation. Proud of their numbers, and insolent with pride, one army rises from a night spent in counting chickens which have ne'er been hatched, and throwing dice for rich lands not yet secured. Anon they chide the cripple, tardy-gaited night, which limps so tediously away. They wait the morn, expectant and exulting. The poor wretches whom they have already, in imagination, condemned, like sacrifices, by their watch fires, sit patiently, and inly ruminate the morning's danger. Oh, now behold the royal captain of this seeming ruined band, walking from watch to watch, from tent to tent. He bids them all good morrow with a modest smile, and calls them brothers, friends, and countrymen. Beholding him, with his cheerful semblance and sweet majesty, one and all pluck comfort from his looks. A largess, universal as the sun, his liberal eye doth give to every one, thawing cold fear, and infusing his heroic nature into all. The scene is blurred over with bloodshed ; but a ray of light reveals this royal captain, victorious against fearful odds, exclaiming, " O, God, thy arm was here ! and not to us, but to Thy arm alone, ascribe we all ! "

Answer : Agincourt. See Shakspeare's Henry V.

Should difficulty be found in painting in words a "Mental Scene" for the company to discover, a capital plan—as the above example will have indicated—is to read a passage from some great writer, such as Shakspeare, or Macaulay, or Sir Walter Scott, or Tennyson, or Carlyle, and leave it to the discernment of the audience to give the name of the scene or incident related. The passage should of course be complete in itself, not too long, and proper names of persons and places which might give a definite clue to the subject of the reading should be removed, and abstract terms like "the hero," "the heroine," "the scene of conflict," and so on, used in their stead. Remember, it is useless to select a "scene" so difficult that no one could identify it or so easy that everybody could discover it.

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